POWER TRANSMISSION DESIGN

MARCH 1960

OEM·· MAINTENANCE

SPECIAL REPORT:
ENCLOSED GEAR DRIVES

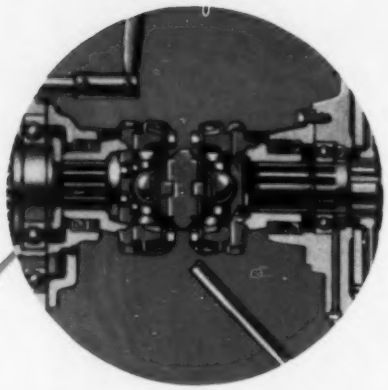
INCLUDING BEARINGS DESIGN/APPLICATION

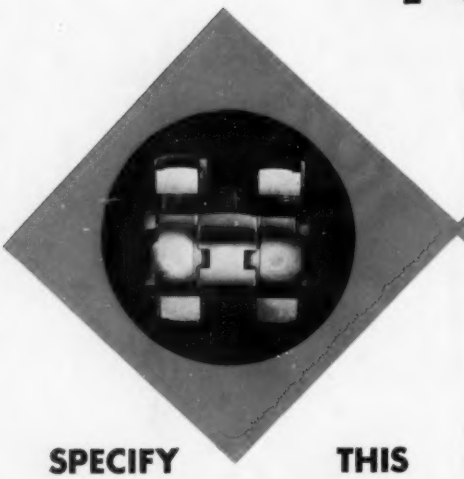
ALSO IN THIS ISSUE:

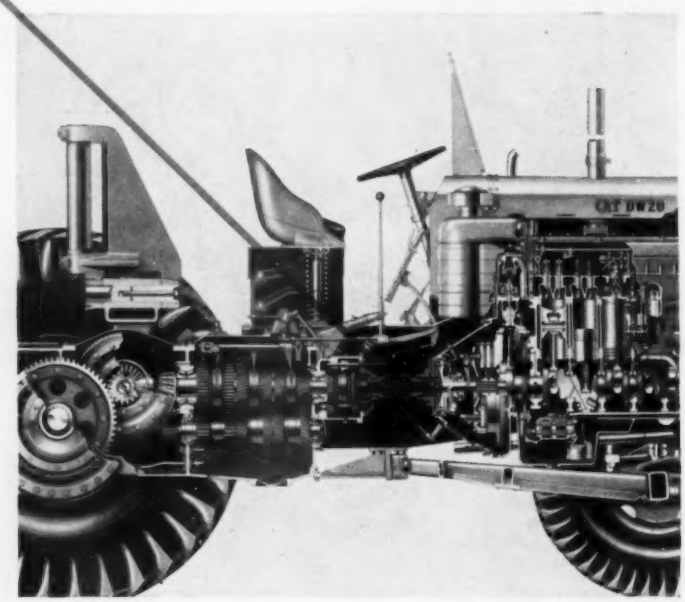
Servo Motor Controls Hydraulic Positioning

Bearing Noise Is Often Louder Than You Think

LIMITED SPACE CALLS FOR CLOSER COUPLING







SPECIFY THIS CLOSE-COUPLED "C"-TYPE

MECHANICS ROLLER BEARING UNIVERSAL JOINT

If you are faced with the problem of locating a universal joint in a space where limited clearance does not permit the use of a flanged joint, MECHANICS close-coupled "C" Type Roller Bearing UNIVERSAL JOINT is your solution. This joint is specially designed for operation within cramped quarters that engineers formerly considered too short to accommodate a universal joint. Let our engineers show you how MECHANICS close-coupled UNIVERSAL JOINTS will conserve space, compensate for offset shafts and provide ample angularity in your new, compact models.

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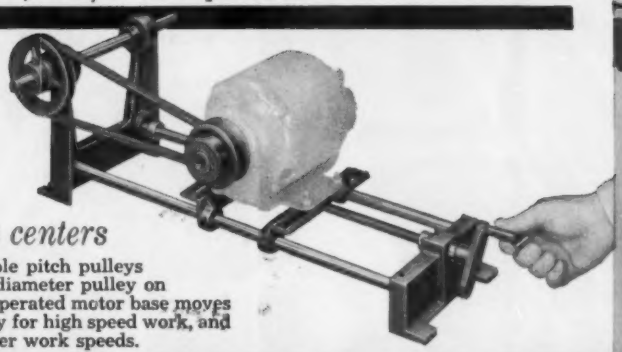
maurey

spring loaded pulleys give you a choice of two variable speed drives

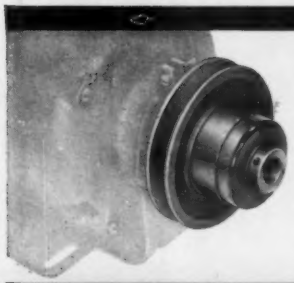
ratios up to 4:1, on 1/8 to 2 h.p. drives

1



. . . *with variable centers*

With spring-loaded, variable pitch pulleys on motor shaft, and fixed diameter pulley on driven shaft. Hand wheel operated motor base moves motor close to driven pulley for high speed work, and away from pulley for slower work speeds.

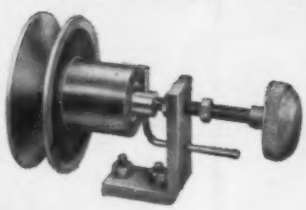


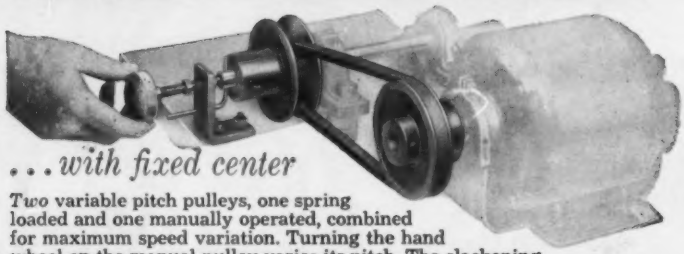
AUTOMATIC

Spring Loaded Pulley. Belt pressure controls pitch diameter. 4 sizes: 3¼", 4", 5" and 6" O.D.

MANUAL

Spring Loaded Pulley. Hand wheel controls pitch diameter. 4 sizes: 3¼", 4", 5" and 6" O.D.



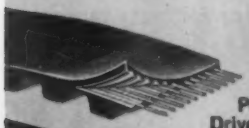


2

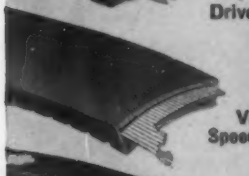
. . . *with fixed center*

Two variable pitch pulleys, one spring loaded and one manually operated, combined for maximum speed variation. Turning the hand wheel on the manual pulley varies its pitch. The slackening or tightening belt produces instant, automatic pitch adjustment of the spring loaded driver pulley for positive driving at the desired speed.

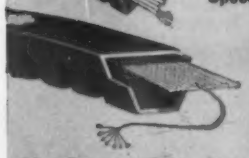
get more **drive** *with Maurey drives*



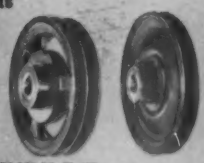
Positive Drive Belts



Variable Speed Belts



Mor-Grip V-Belts



Hi-Q FHP V-Pulleys

Complete heavy duty V-Belt Drives

Maureymatic Variable Speed Transmissions

Sprockets

Roller Chains

WRITE FOR CATALOGS

Here is variable speed flexibility, at truly low cost. You can use any Maurey Spring Loaded Pulley on any drive from ⅛ to 2 h.p., with any standard motor. On original equipment it involves no changes in design. On equipment in use it is installed quickly and easily. Their spring-tensioned flanges hold "A" or "B" belts in a constantly firm grip, even while you change ratios.

Get full information now,

from the Maurey Distributor listed in your local "Yellow Pages", or write direct to Maurey for catalog information.

maurey

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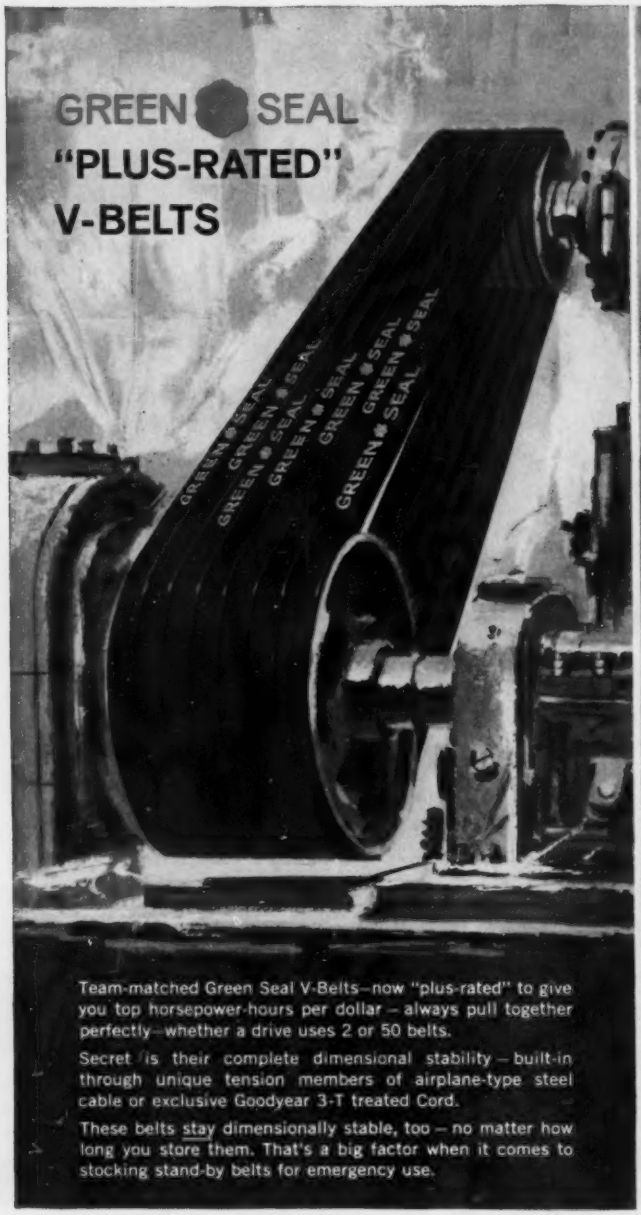
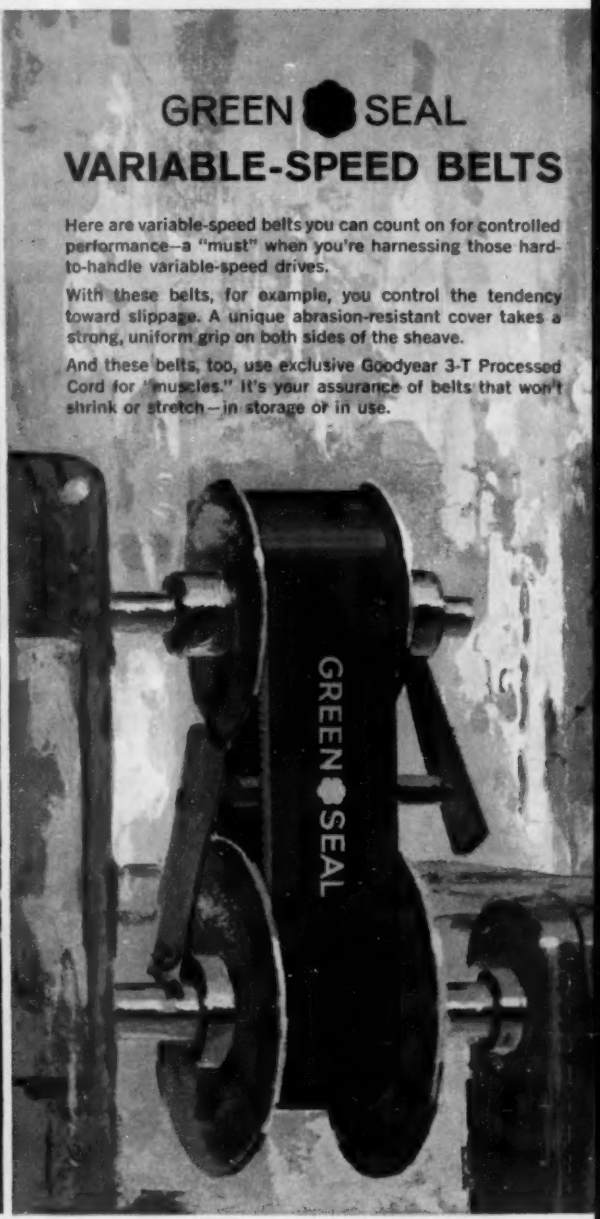
to beat all your belting problems..



Team-matched Green Seal V-Belts—now "plus-rated" to give you top horsepower-hours per dollar – always pull together perfectly—whether a drive uses 2 or 50 belts.

Secret is their complete dimensional stability – built-in through unique tension members of airplane-type steel cable or exclusive Goodyear 3-T treated Cord.

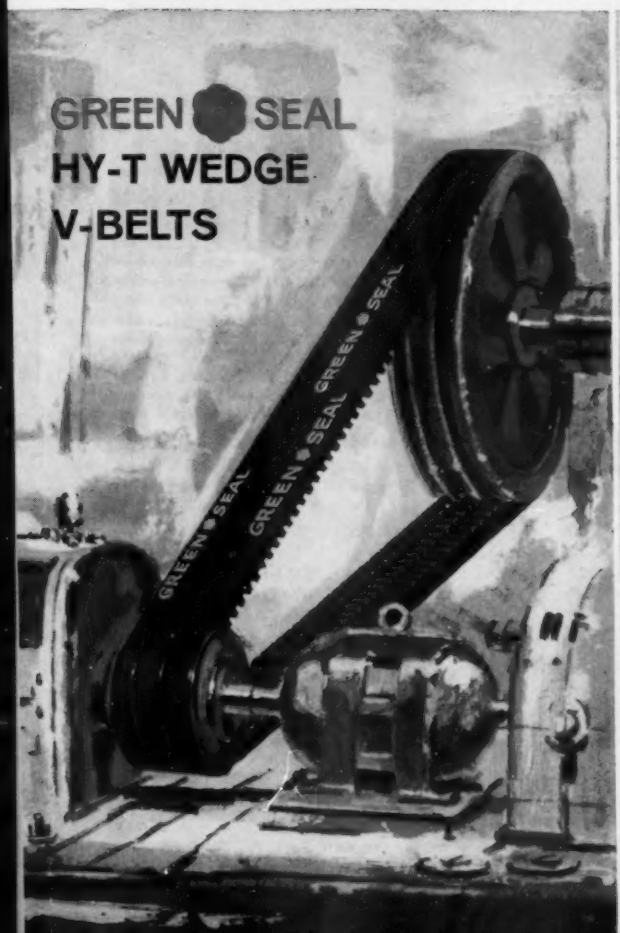
These belts stay dimensionally stable, too – no matter how long you store them. That's a big factor when it comes to stocking stand-by belts for emergency use.


GREEN SEAL
VARIABLE-SPEED BELTS
Here are variable-speed belts you can count on for controlled performance—a "must" when you're harnessing those hard-to-handle variable-speed drives.
With these belts, for example, you control the tendency toward slippage. A unique abrasion-resistant cover takes a strong, uniform grip on both sides of the sheave.
And these belts, too, use exclusive Goodyear 3-T Processed Cord for "muscles." It's your assurance of belts that won't shrink or stretch—in storage or in use.
GREEN SEAL

NO MATTER WHAT YOU'RE BELTING–OR WHAT TYPE BELT IT CALLS FOR–YOU CAN COUNT ON A GOODYEAR BELT FOR MAXIMUM, TROUBLE-FREE HOURS AT MINIMUM COST. JUST CONTACT THE

THE BIG NAME IN V-BELTS: GOOD

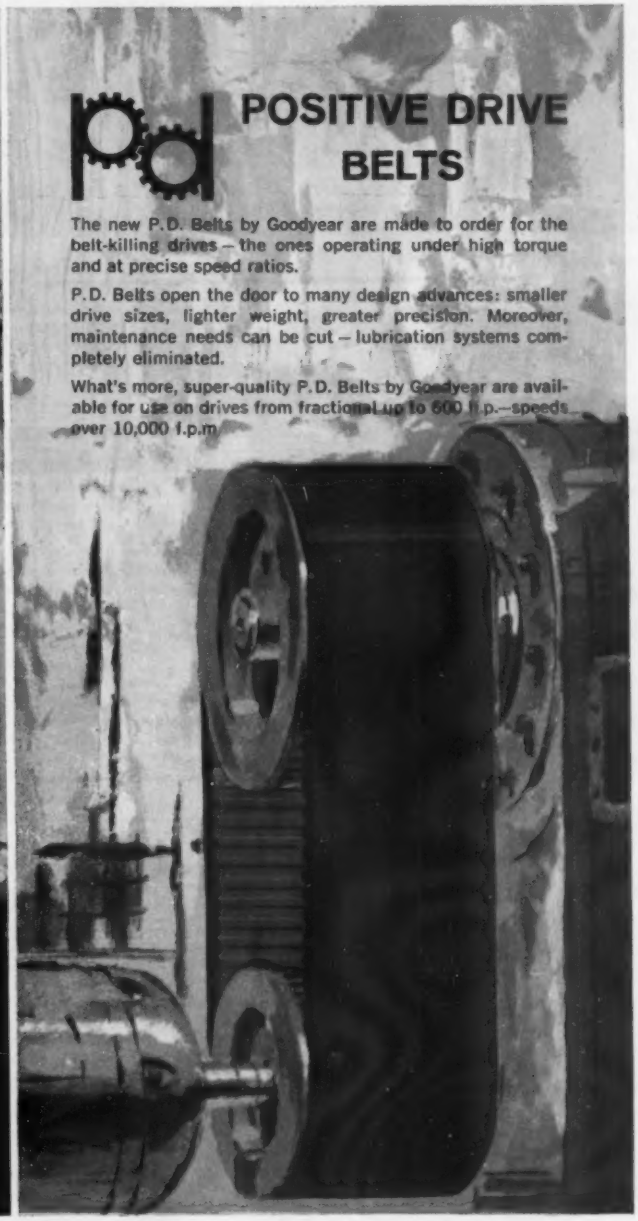
go down the line with Goodyear



With these new, "wedge" V-Belts, you can belt the same horsepower on drives as much as 50% smaller – saving as much as 20% in drive costs.

You see, the new HY-T WEDGE design eliminates excess "fat" without the sacrifice of strength. And HY-T WEDGE V-Belts are made in 3 different cross sections to meet all requirements. All 3 are oil-resistant and static-conducting at no extra cost.

And they're all Green Seal quality – the only wedge-type V-Belts offering you 3-T construction for perfect team performance.



POSITIVE DRIVE BELTS

The new P.D. Belts by Goodyear are made to order for the belt-killing drives – the ones operating under high torque and at precise speed ratios.

P.D. Belts open the door to many design advances: smaller drive sizes, lighter weight, greater precision. Moreover, maintenance needs can be cut – lubrication systems completely eliminated.

What's more, super-quality P.D. Belts by Goodyear are available for use on drives from fractional up to 600 h.p.—speeds over 10,000 f.p.m.

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YEAR

THE GREATEST NAME IN RUBBER

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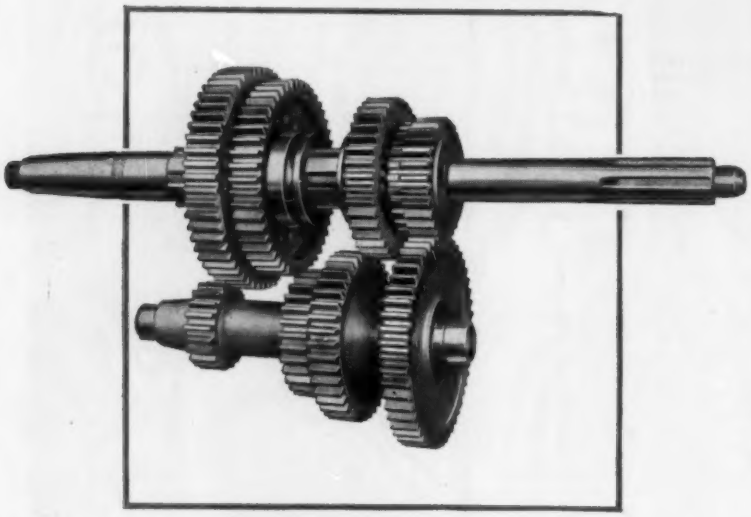
gears

...FOR A WORLD AT WORK



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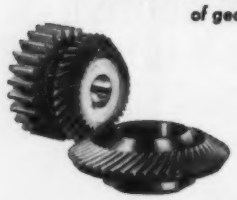

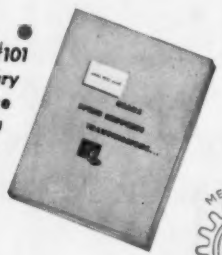

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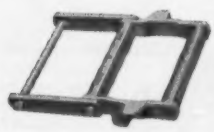
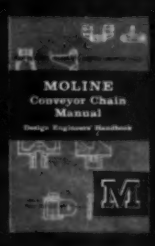
SELECTION CHART for triple-tested Moline Chains*

Here is a quick, easy reference chart for comparing the seven most popular Moline Chains. Are you familiar with all the attachments available... the range of sizes... and all their applications? This chart will help you compare their size, capacity range and various uses. It's a part of the new, illustrated "Moline Conveyor Chain Manual and Design Engineers' Handbook" which is available now to help you specify the right chain for your requirements. Write today for your copy.

	CHAIN TYPE & NUMBER	APPLICATION AND INSTALLATION	ATTACHMENTS	PITCH RANGE IN INCHES	ULTIMATE STRENGTH IN LBS.
	Detachable Chains—25, 32, 33, 34, 42, 45, 50, 51, S-51, 52, 55, 57, 62, 67, 75, 77, 78, 88, 95, 103, 108, 114, 124	Widely used throughout industry, conform to "manufacturers' standard" and available in a wide variety of sizes. Many attachments make this type versatile and adaptable to any light to medium-duty conveyor service.	A-1-2-3-12-110 C-1-5-8-15 D-3-4-5 E-1 F-2-8-16 K-1-2-3-5-40-73-345 H-1-2 K-1-2-3-5-40 L-2 M-1-3 R-1-2 S-1 Scraper 1-29	.902 to 4.063	700 to 17,000
	Pintle Chains 400 class. Light weight Pintle. 700 class.	Serviceable, long-wearing, moderately-priced chain for general elevating, conveying and power transmission service for drives at low and intermediate speeds with moderate loads. In "400" lightweight and "700" class types.	A-1-12-115 D-5 E-1 F-2-5-16 G-1-6-19 K-1-2 M-1 F-2-5 F-22-6" F-2-22-8" A-2-42 K-1-2-720-A-2-730 720-M-1 M-1-2	1.375 to 4.720	4,200 to 22,000
	H-Type Mill H-60, H-62, H-74, H-75, H-78, H-82, H-85, H-87, H-95, H-124	Designed primarily for heavy drives and transfer conveyors in saw mills and pulp and paper mills but widely used throughout industry. Strong and rugged, provided with wearing shoes for stiffness and long service life.	A-1-12 F-4 G-1-6-19-48 H-1-2 K-1-2 M-3 R & L RR	1.654 to 4.000	7,000 to 30,000
	Combination Type Mill Chain 6104, 6110, 8116, 8480	Designed for the same applications as regular H-type conveyor chains and refuse chains but has larger diameter rivet, greater ultimate strength for more rugged duty in general drag conveyor service applications.		6.00 to 8.00	42,000 to 56,000
	Combination Chains—C-55, C-77, C-102B, C-102½, C-110, C-110-C, C-111, C-111-C, C-131, C-131-C, C-132, C-132-C, PW-132, C-188, MW-188	Very rugged and serviceable for use in bucket, transfer and many other types of conveyors. Widely used in cement, chemical, lumber, quarrying, mining industries. Available in pin and cotter assembly or riveted construction.	C-3-132 RF-12 F-2 G-6-19 K-1-2-3 LL-25	1.631 to 6.050	9,000 to 50,000
	Dairy Conveyor MC-33	Extensively used in dairy and bottling industries, designed for both horizontal and lateral turning. Detachable construction, interchangeable with manufacturers' standard 4250, available only in extra strength Promal.		2.500 only	12,000
	Ley bushed Chain—823, 825, 830, 844	Developed for hard, rugged service under extremely abrasive and other adverse conditions. Used extensively in conveying or elevating sand, gravel, cement and in similar industries where service demands are rigid.	K-2 F-2	4.00 to 6.00	19,000 to 40,000

Write today for your free copy of the Moline Conveyor Chain Manual and Design Engineers' Handbook.



*Call your nearby Moline dealer today for help on your chain problem. Complete design service available for special chains or unusual applications.

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MARCH 1960

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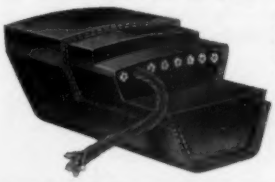
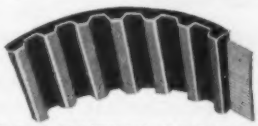
DA 358 V-BELTS



For highly compact, plus-power drives. First major design change in Multiple V-Belts in the last 30 years.



DA POSITIVE DRIVE BELTS

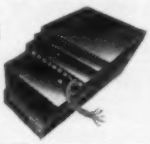
Combines the advantages of the chain and gear with all of the advantages of the belt. No stretch, no metal to metal contact, no constant lubrication.

STURDY-LINK

Pre-stretched link belting available in regular, oil-resistant and static-conductive types.

GENERAL DUTY V-BELTS

Power-balanced construction for flexibility, durability and strength.



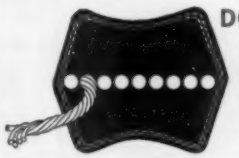
STEEL CABLE V-BELTS

Steel cable permits no-stretch installation. All belts are fluoroscoped to assure extra high quality.

RAILROAD BELTING

High tensile strength, low stretch belting features high fastener tear-out resistance.

DOUBLE V-BELTS



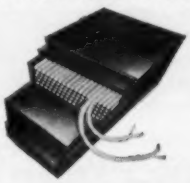
Relieved cross section assures maximum flex resistance. New control methods provide uniform cord section.

OPEN END V-BELTING

Used on drives where endless V-Belts are not practical. High fastener tear-out resistance.

RED SHIELD MULTIPLE V-BELTS

Red Shield Belts now offer 40 per cent extra capacity. Iso Dynamic matching and cord stability assure precise balance and long belt life. Also available in oil and heat resistant and static dissipating constructions.



VARIABLE SPEED BELTS

Abrasion resistant cover assures maximum life. Crowned cross section maintains stability under extreme loads.

Test . . . Compare . . . You'll Select

DURKEE-ATWOOD V-BELTS

DURKEE-ATWOOD COMPANY • MINNEAPOLIS 13, MINNESOTA

Look for the DA *on your V-Belts*

Circle No. 16 on Reader Service Card

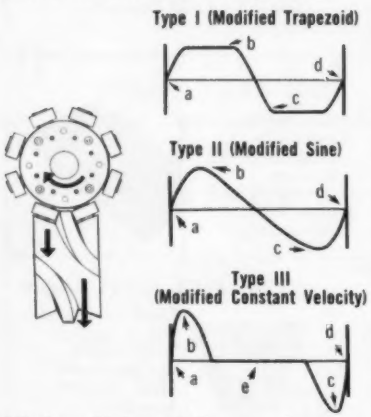
Indexing by SELECTED ACCELERATION for BEST MACHINE PERFORMANCE

The Universal Cam Theory employed by Ferguson Machine Corporation permits utilization of an indexing mechanism with an acceleration characteristic **selected on the basis of required performance** to achieve zero backlash, extreme precision and long, maintenance-free life with the movement characteristics best suited for the application.

Conversely, hit-or-miss methods of specifying a geneva or crank device and accepting the inherent acceleration, or **specifying a single acceleration for all applications,** nullifies many of the advantages of new machine designs.

Any type of acceleration may be employed with the Universal Cam Theory. The three most frequently used by Ferguson are shown below. Each has particular advantages.

FIG. 1 THE FERGUSON DRIVE



All these Universal diagrams have an initial force of zero (a), a sinusoidal increase to maximum (b) and a final value of zero (d).

Type I has the lowest maximum value and a somewhat gradual change to maximum deceleration (c). Its indexing action is smooth and ideally suited for light duty, high speed applications.

Type II maintains relatively low maximum values (b & c) and has an extremely smooth transition from acceleration to deceleration. It is recommended for high inertia, slow speed applications and where cam input torques must be limited.

Type III has the highest acceleration and deceleration values among the three due to the constant velocity period (e). It is used where a constant velocity is necessary or where low impact force, low centrifugal force or a drastically smaller cam is an attribute to the machine's function.

Versatility of the Universal Cam Theory enables Ferguson to design cams of any configuration calculated to enhance the operation of a machine employing intermittent motion.

Designs of other indexing devices, such as geneva drives and ratchets and cranks, do not permit the utilization of different acceleration characteristics. Their vibrations are severe and operating speeds are limited by poor dynamic conditions and backlash. In the case of a geneva drive the value of certain points in the diagram may vary according to the number of stops the drive provides. However, the initial force is always a significant factor, the rise and fall is sharp and the return to zero is abrupt.

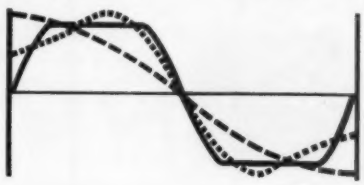
Curves of the geneva, ratchet and crank and Ferguson Drive (Type I) show why **the Ferguson Drive does what no other drive can do . . . and why Ferguson Machine Corporation is the leading designer and manufacturer of cams and cam indexing mechanisms.**

FIG. 2

dotted line — 6-stop geneva drive

solid line — Ferguson Drive, Type I (modified trapezoid)

broken line — ratchet & crank (modified cosine)



Only the Ferguson Drive has initial and final forces of zero combined with low maximum values and a gradual change. The geneva and crank devices' inherent characteristics are dynamically poor and restrict their usefulness for modern production requirements.

Get more information on high speed, precision indexing. **SEND FOR CATALOG NO. 160.** It's the most comprehensive catalog of intermittent motion equipment ever published, containing complete application data on index mechanisms and tables, in-line machines, dial feeds and other standard components and machines. Be sure you have a copy. Write

Ferguson Machine Corporation
7818 Maplewood Industrial Court
St. Louis 17, Missouri

Circle No. 18 on Reader Service Card

LETTERS

Address letters to:
The Editor
Power Transmission Design
812 Huron Road, Cleveland 15, Ohio

Requests continue

Gentlemen:

We are still getting requests for reprints of the article on "Bearings, Design/Application" from the September issue of your magazine. If there are reprints still available, we would like to have four more. These are for designers in our Continuous Miner Dept.

ANNA WALKER
Engineering Secretary
Joy Manufacturing Co.
Franklin, Pa.

. . . We have the December issue and have read with great interest the article on mechanical adjustable speed drives. We feel that you have performed a real service to industry by collecting the information presented in this article. We would like 30 reprints.

R. D. BLACK
Vice President
The Zero-Max Co.
Minneapolis, Minn.

. . . Would it be possible to get 100 copies of the article "Adjust Your Speed, Any Speed, Precisely—Electrically" in the November issue. We would like to send these to each of our district offices, and emphasize their reference to your magazine regularly.

ROGER N. BURGESS
Manager, Distributor Sales & Marketing
The Louis Allis Co.
Milwaukee, Wis.

. . . We want 100 copies of the article "Adjust Your Speed, Any Speed, Precisely—Electrically" starting on page 18 in November.

JACK T. CULLETON
Chief Engineer
Pacific Pumping Co.
Oakland, Calif.

Circle No. 11 on Reader Service Card

Complete line of Sprockets, Chains, Flexible Couplings . . . everything you need for quality Roller Chain Drives.

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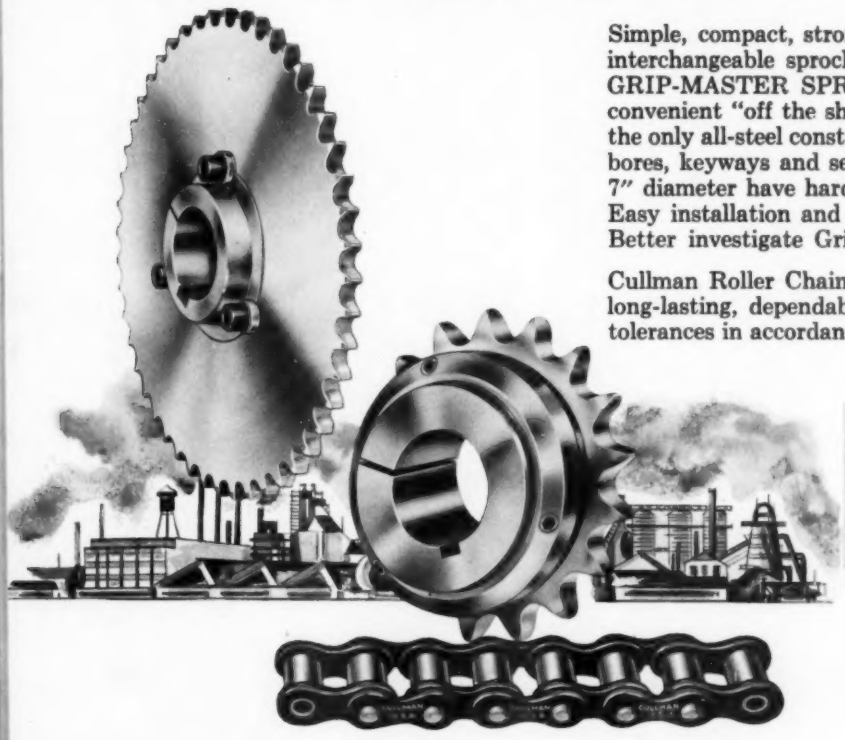
Cullman *Grip-Master*® Sprockets

sure to reduce chain drive costs!



Simple, compact, strong . . . featuring interchangeable sprockets, hubs and bushings—GRIP-MASTER SPROCKETS are ready to use in convenient "off the shelf" sizes and styles . . . the only all-steel constructed sprockets with standard bores, keyways and setscrews. Sprockets up to 7" diameter have hardened teeth for longer wear. Easy installation and removal. Better investigate Grip-Master today.

Cullman Roller Chain . . . precision-made, long-lasting, dependable—manufactured to close tolerances in accordance with A.S.A. specifications.

Distributors in all principal cities.

FACTORY WAREHOUSES AT:
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Cullman Wheel Company 1344 Altgeld Street • Chicago 14, Illinois

write today for latest free literature . . . competent engineering counsel on all your chain drive problems. No obligation!

Roller Chain Drives Since 1893

wheel

WAGNER Integral-Type Gearmotors

FOR THE POWER YOU WANT AT THE SPEED YOU NEED

Wherever you need "slower than motor speeds" you can get positive speed reduction with plenty of power by using Wagner Gearmotors.

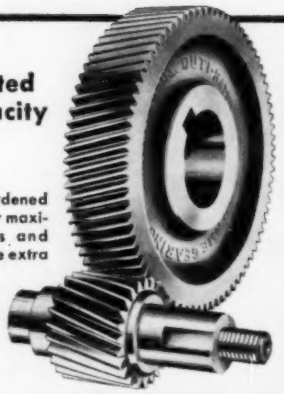
This extension to the Wagner line provides compact motorized drives, with both motor and gear housing of corrosion-resistant cast iron. Available with the latest NEMA Frame open protected or totally enclosed fan-cooled motors, they combine Wagner motor dependability with rugged, simplified gear units to give you speed reduction equipment designed for greater capacity and longer life in ordinary up to rough service.

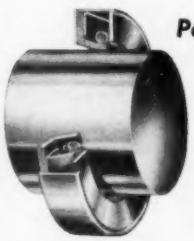
Wagner Gearmotors offer a wide variety of sizes in single, double, triple or quadruple reductions, horizontal or vertical foot or flange mountings—speeds from 7½ to 780 RPM. Write for Bulletin MU-227.

Whether you specify or apply power transmission equipment, your nearby Wagner Sales Engineer will be glad to help you select the right drive for your applications.

Heat treated high capacity helical gears

Gears are hardened after cutting, for maximum hardness and accuracy, to give extra capacity and longer wear life.





Positive Oil Seals

Improved lip type seals are used on horizontal shafts. On vertical output shafts, double mechanical seal with slinger and drain-off gives positive protection against leakage.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

WH59-12

Wagner Electric Corporation

6385 Plymouth Ave., St. Louis 14, Missouri.

SERVING 2 GREAT GROWTH INDUSTRIES...*ELECTRICAL*...*AUTOMOTIVE*

Circle No. 51 on Reader Service Card

MEN of the power transmission field

Acker named manager of Eaton divisions

CLEVELAND, OHIO—Eaton Mfg. Co.'s subsidiary, Cleveland Worm & Gear Co., and Cleveland Worm & Gear's subsidiary, Farval Corp., have become divisions of Eaton under their present names. George H. Acker, president of Cleveland Worm & Gear and Farval, has been named general manager of the two divisions with full administrative responsibilities Acker joined Cleveland Worm & Gear in 1923, was elected vice president, engineering and production, in 1942 and became executive vice president of the firm and Farval in 1952. He became president three years ago.

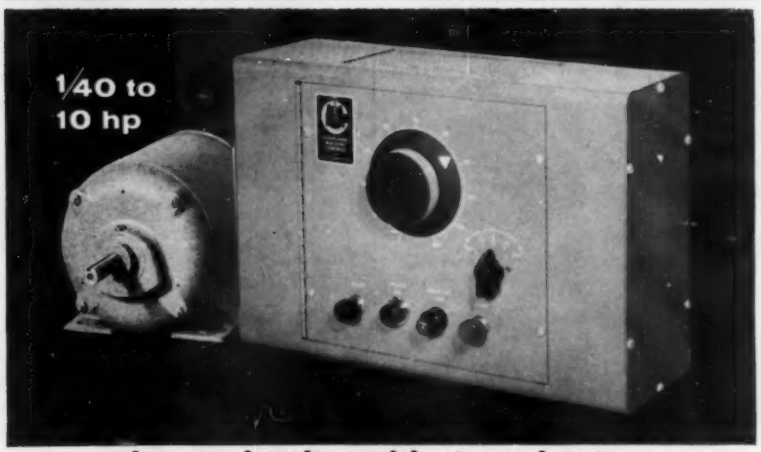
ACKER

Ferguson on MPB board

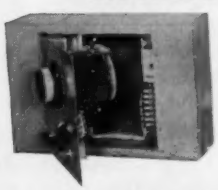
KEENE, N. H.—Hugh S. Ferguson, president of National Research Corp., has been elected to the board of directors of Miniature Precision Bearings, Inc.

Prudential Industries names board chairman

PHILADELPHIA, PA.—Oliver J. R. Troup, founder and president of Prudential Industries, is now chairman of board, a new position. Prudential



Electrical Adjustable Speed Drives



If you are looking for a compact, low-cost electrical drive and your application does not demand the precise speed regulation of an electronic unit, you may find exactly what you need in the CMC line of Electrical Adjustable Speed Drives . . . These skillfully engineered drives require only four wires to the dc motor and two for ac power . . . Complete with dripproof 1750 rpm dc motors. Gearhead, totally enclosed and other motor types available.

COMPACT CONTROL UNIT • MODULAR CONSTRUCTION • INFINITELY VARIABLE REVERSING AND DYNAMIC BRAKING STANDARD • IMMEDIATE DELIVERY

We also offer a complete line of full-wave electronic drives featuring fine speed regulation, wide range of adjustment and unique construction.

CLEVELAND MACHINE CONTROLS, INC.

1155 BROOKPARK ROAD CLEVELAND 9, OHIO

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Save $ $ $ $

ATLAS UNIVERSAL JOINTS

Balanced to operate without vibration at all speeds. Short, stubby jaws give maximum resistance to spread. Larger diameter joints fitted with big grease reservoir. Standard alloy steel joints in fifteen sizes for all requirements. Also made in Bronze, Monel and other special metals.

Universal Slip Shafts a specialty.

WRITE for illustrated catalog giving data and specifications.

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GRAY & PRIOR

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607 WINDSOR ST.
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OHIO
SPEED REDUCERS & STOCK GEARS

A complete line available from local stocks everywhere

NEW OHIO LINE

These fin and fan cooled reducers give up to 80% more capacity in far less space. Over 100 models from 1/16 to 18 horsepower. Available with "C" flange motor mounts.

U Series P Series S Series

Non-Ventilated Models

Single Worm Double Worm Bevel Gear Helical Gear

Spur Gears Worm Gearing Miter Gears

Helical Gears Fibre Gears Bevel Gears

Local Stocks In 50 Cities
Gears & speed reducers available for immediate delivery . . . see Yellow pages for name of your local distributor.

Free Catalog
Provides complete dimensions and engineering data on hundreds of off-the shelf items.

Ohio also supplies "special" gears and speed reducers

Ohio **OHIO GEAR CO.**
1323 EAST 179th ST. • CLEVELAND 10, OHIO

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MEN *continued*

Industries is the parent corporation of Atlas Precision Products Co. and Measurements Research Co., divisions, and Atlas Chain & Mfg. Co., a subsidiary. Edward J. Rexer, former executive vice president of Prudential and acting sales manager of Atlas Chain, takes over as president of Prudential.

Syburg appointed at Chain Belt

MILWAUKEE, WIS.—Frederic G. Syburg has been appointed vice president in charge of Chain Belt Co.'s international operations. Syburg,

SYBURG

formerly vice president of purchasing, also will serve as president of Rex International S. A., Chain Belt's recently-organized foreign sales company. He'll have corporate responsibility for all operations outside the U. S. and Canada. Syburg joined Chain Belt in 1916.

Hewitt-Robins' Gardner now executive v.p.

STAMFORD, CONN.—Ellis B. Gardner has been appointed executive vice president of Hewitt-Robins, Inc. Gardner, who joined the company in 1946, became controller in 1950 and vice president and treasurer the same year. Since 1955 he's headed the firm's foam products division.

Joins Western Gear

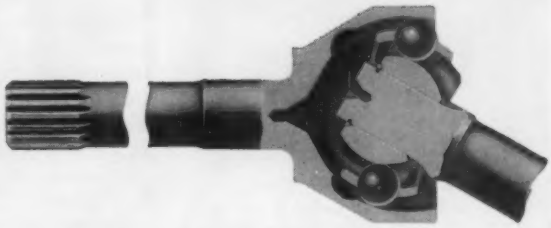
LYNWOOD, CALIF.—Steve Moreland has joined Western Gear Corp.'s Portland office as a sales engineer for the Industrial Products Div. line of gearmotors, speed reducers, and other mechanical power transmission equipment.

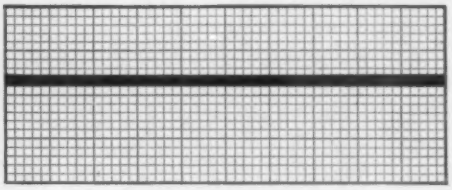
RZEPPA Universal Joints Transmit Torque Smoothly—*Even At High Angles!*

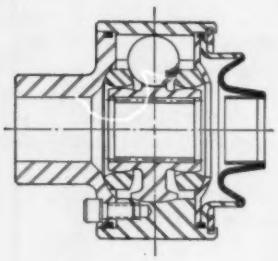
Rzeppa universal joints transmit 100% precision-smooth torque continuously—at angles of 35° and higher! Constant velocity action completely eliminates chatter, roughness and vibration. Size for size, you get longer shaft and bearing life, higher torque capacity with Rzeppa joints than with any other type!

The secret of Rzeppa's uniform power flow is that the driving balls are always in the bisecting plane of the driving and driven shafts. No matter what the shaft angle, torque flows evenly at constant velocity.

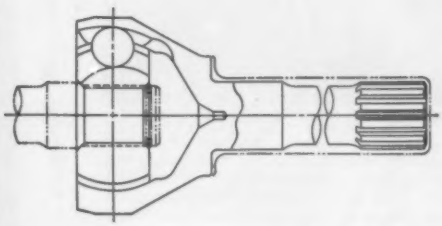
Rzeppa constant velocity joints are available in a wide variety of sizes, styles, angles and speeds. Rzeppa joints have been used successfully in equipment ranging from giant road-building and mining equipment to the most intricate aircraft and missile applications.



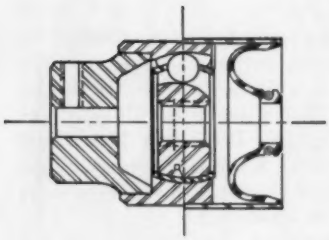




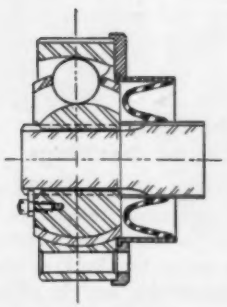
"MX" Type CV Joint (⅞" to 3½" swing diameter) . . . designed primarily for high speeds, low angles . . . blowers • compressors • servo motors • pumps • control devices • frequency converters • missiles • aircraft • dynamotors



Bell-Type CV Joint (15/16" to 2½" axle shaft diameters) . . . designed for high-angle driving steering axles used in road building machinery • mining machinery • industrial • automotive applications



"OV" Type CV Joint (2⅛" maximum swing diameter) . . . designed for smaller applications . . . ordnance • machine tools • servo mechanism • farm equipment • automotive equipment



Disc-Type CV Joint (from 2⅛" to 16¼" swing diameter) . . . designed for all types of industrial drive applications where constant velocity and trouble-free service are required.

WRITE

for this new engineering data folder on the complete line of Rzeppa constant velocity joints. No cost or obligation to you.

Please send my copy of Con-Vel's NEW engineering data folder on CV universal joints.

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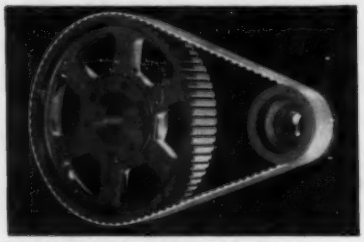
WOOD'S POWER TRANSMISSION PRODUCT NEWS



POSITIVE ACTION—LONG LIFE

Wood's Timing Belt Drives provide positive, slip-free action. Belts are all muscle. No high initial tension, tension devices or lubrication needed. Drives are light weight, compact . . . quiet and clean. Wide load and speed range. Equipped with famous Sure-Grip Bushings. Write for Bulletin 2100.

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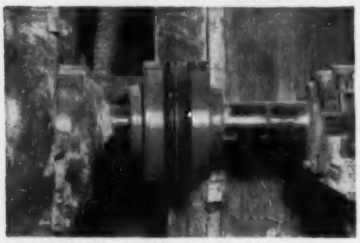

4-WAY FLEX—UNIQUE DESIGN

Wood's Sure-Flex Couplings absorb 5 to 15 times more shock and vibration than other leading flexible couplings . . . swallow all types and combinations of angular and parallel misalignment, end-float. Simple, no wear, no lubrication. Low cost. Write for Bulletin 5103.

Circle No. 55 on Reader Service Card

REVOLUTIONARY NEW VARIABLE

Revolutionary resilient cam follower construction of Wood's new "MCS" motion control, variable speed drives holds constant driven speeds under varying torque loads. Like the "MS," the "MCS" won't freeze or stick. Check oil only once or twice a year. Write for Bulletins 8102, 4101.

Circle No. 56 on Reader Service Card

MP/360A

Woods

T. B. WOOD'S SONS COMPANY

CHAMBERSBURG, PENNSYLVANIA

ATLANTA • CAMBRIDGE • CHICAGO
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NEWS *from the power transmission field*

Equipment distributors form association

WASHINGTON, D. C.—At a recent meeting held in Chicago, power transmission equipment distributors formed an association to "exchange ideas, experiences, and information of value and benefit to all mechanical power transmission equipment distributors."

The new group—Mechanical Power Transmission Equipment Distributors Association—elected these officers: president—Warren M. Pike, Warren M. Pike Associates, Inc.; vice president—William Appleby, General Chain & Belt Co.; treasurer—Robert Booth, Power Transmission.

PIKE

Directors are: K. D. Adam, Raymond L. Blair, Wayne Bodine, Martin H. Borgford, Clayton Cousino, John W. Dadmun, G. G. Etheridge, Ward S. Garrison, Paul D. Mahoney, Harlan C. McKay, and S. M. Weiser.

Membership is limited to distributors who operate "free of financial control from any manufacturer whose equipment he sells, and who has contracts or agreements with manufacturers of power transmission equipment for representation in a specific territory." Members must transact at least half of their total dollar sales from power transmission equipment, and must carry at least four major component lines in this equipment.

Power transmission equipment was defined as "all those mechanical components which are instrumental in the transmission of motion from the prime source of power to the ultimate objective of the drive. This includes electric motors, providing they are an integral part of other power transmission items."

Membership dues were set at $200 a year. Allied memberships for non-qualifying applicants, such as manufacturers, were deferred for later consideration by the full membership.

Shortly after the association was formed, it announced an aptitude testing service available to member distributors for hiring salesmen. Tests, to be conducted by the Executive Analysis Corp., are designed to reduce the risk involved in hiring new salesman, enabling the distributor to evaluate a new man in one to three months.

Address of the Mechanical Power Transmission Equipment Distributors Association is:

1028 Connecticut Ave., N.W.
Washington 6, D. C.

ASLE annual meeting

CHICAGO, ILL.—The 15th annual meeting and lubrication exhibit of the American Society of Lubrication Engineers will be held in Cincinnati, Ohio, at the Netherland Hilton Hotel, April 19-21. More than 2000 executives and lubrication engineers are expected to attend, and to hear more than 50 speakers.

John Boyd, manager, Bearing and Lubrication Section, Westinghouse Research Laboratories, will receive the 1960 ASLE National Award.

Bibliography on gas lubricated bearings

WASHINGTON, D. C.—A bibliography of 290 technical references in the field of gas lubricated bearings has been prepared by The Franklin Institute laboratories and is offered for sale by the Office of Technical Services, Business and Defense Services Administration, U. S. Dept. of Commerce.

Wherever possible, a resume in English of each reference is included. In most cases, abstracts were taken

NOW, THE ULTIMATE IN V-BELT DRIVES

WOOD'S Ultra V DRIVES

SAVE SPACE . . . AS MUCH AS 50%
REDUCE WEIGHT . . . UP TO 27%
CUT COSTS . . . 30% AND MORE

Tremendous savings? You bet they are. And there are more . . . savings on bearings, bases and housings, for instance. Why? Because new, Wood's Ultra-V Drives have exceptional strength and compactness.

New, greatly improved belt materials and new belt construction assure unmatched dimensional stability, amazing strength, greater grip, added support and equalized load for tension members. Belt capacity has been increased radically. Cross sectional areas have been reduced 50% with no loss in belt life. Three Ultra-V Belt cross sections replace 5 of the conventional type, simplifying inventory problems. These compact new belts are oil, heat and exposure resistant and static conducting.

New, high performance, Ultra-V Sheaves have smaller diameters, less width, less weight and tremendous strength. Center distances are reduced. Add to these many advantages the unique features of Wood's Sure-Grip interchangeable bushings. These "easy on—easy off" bushings are *the* most universally used type. Fewer sizes cover a wider bore range. Reverse as well as standard mounting offers maximum flexibility.

Complete details are contained in Bulletin 9102. Write for your copy.

UV/160

Wood's

T. B. WOOD'S SONS COMPANY
CHAMBERSBURG, PENNSYLVANIA

ATLANTA • CAMBRIDGE
CHICAGO • CLEVELAND • DALLAS

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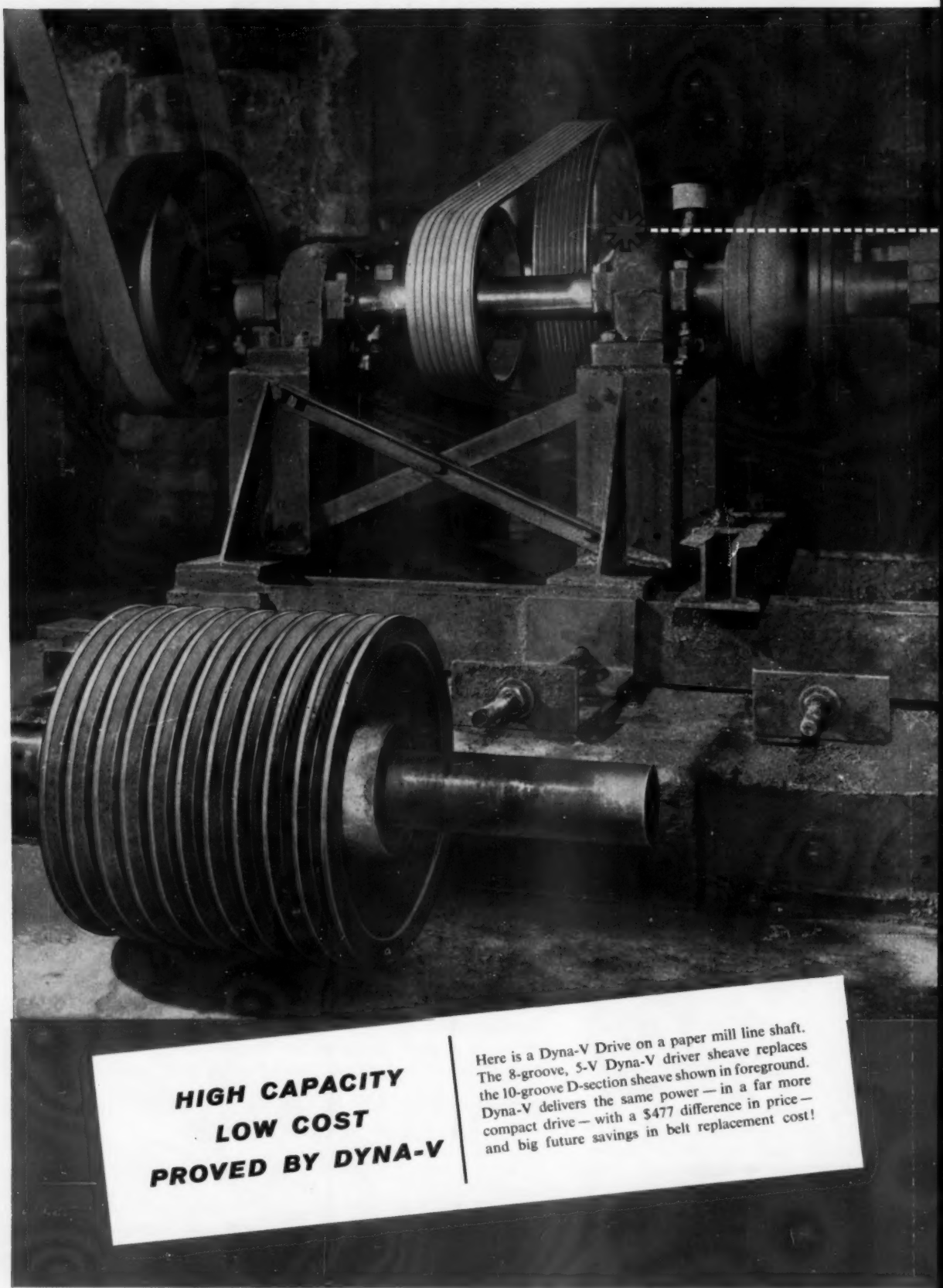
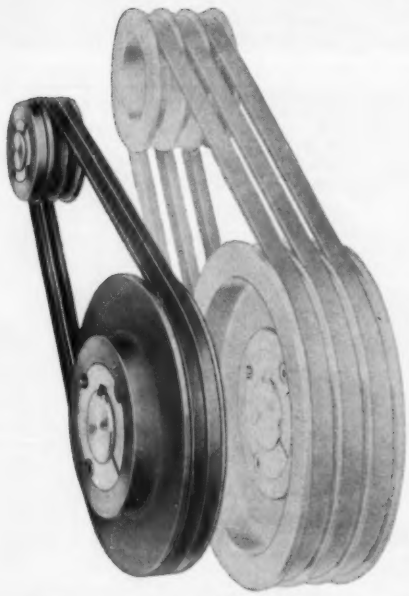


HIGH CAPACITY
LOW COST
PROVED BY DYNA-V

Here is a Dyna-V Drive on a paper mill line shaft. The 8-groove, 5-V Dyna-V driver sheave replaces the 10-groove D-section sheave shown in foreground. Dyna-V delivers the same power — in a far more compact drive — with a $477 difference in price — and big future savings in belt replacement cost!

Dyna V

THE NEW MONEY-SAVING IDEA IN V-BELT DRIVES!



Dyna-V compared with big-groove drive for same hp. Dyna-V is capable of handling 3 times as much hp in the same space! Dyna-V Drives are available for capacities from 1 to 1500 hp.

CALL THE TRANSMISSIONEER — your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioneer" in the *white* pages of your telephone directory, or in the yellow pages under "Power Transmission Machinery".

The day of big-groove sheaves and belts is passing. The new idea of compact V-belt drives—Dyna-V—introduced by Dodge just a few short months ago, is taking the country by storm. Thousands of Dyna-V Drives are at work in industry everywhere, carrying their loads easily, dependably, and proving their ability to *deliver more horsepower per dollar!*

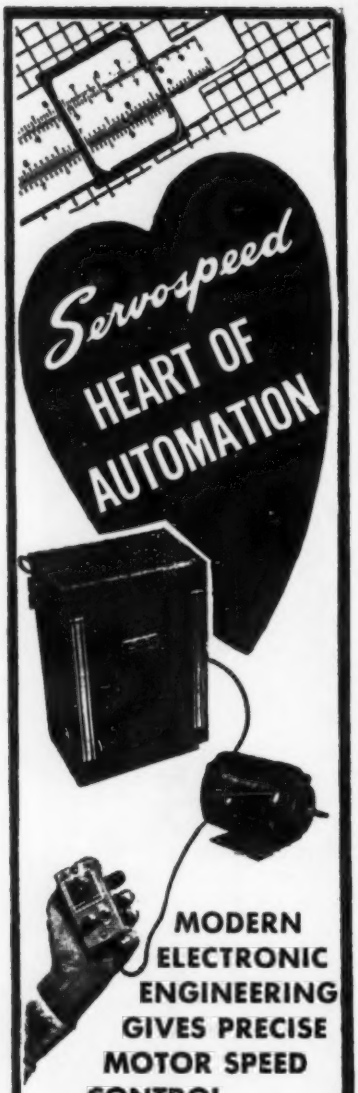
Dyna-V utilizes the full performance possibilities of today's great synthetic fibers for belts—and modern metals for sheaves. Narrow belt top widths team up with narrow sheave grooves to create Dyna-V compactness. Narrow grooves reduce face width—save weight. Costs are lowered. Smaller diameter sheaves and shorter center distances multiply savings. With Dyna-V you cut costs on most initial installations and economize on belt replacements as well. In medium and high hp ranges these savings can be as much as 30%.

Dyna-V Sheaves decrease shaft overhang—increase bearing life. And Dyna-V Belts possess all premium qualities. Conditions requiring oil, heat, moisture resistance or static conductivity are met by Dyna-V's one grade—the finest. Ask your local Dodge Distributor. Or write us for Dyna-V Bulletin.

DODGE
of Mishawaka, Ind.

DODGE MANUFACTURING CORPORATION, 8200 UNION STREET, MISHAWAKA, INDIANA

Circle No. 15 on Reader Service Card



MODERN ELECTRONIC ENGINEERING GIVES PRECISE MOTOR SPEED CONTROL

1/100 — 10 H. P.

Modern industrial electronic engineering has been coordinated with electric motor design to provide a versatile means for obtaining the full possible advantage of speed control in DC motors while operated from the regular alternating current power line. Grid controlled "Thyratron" tubes are utilized for power controlled stepless variation to supply motor armature power. Patented feedback, or "Servo" circuits provide constant torque capability over wide speed ranges of as high as 60 to 1 in some models and a minimum of 20 to 1 in others.

Servospeed
DIV. of ELECTRO DEVICES Inc.
4 Godwin Ave., Paterson, N. J.
ARmory 4-8989

Circle No. 42 on Reader Service Card

NEWS *continued*

verbatim from the author, translation being made where required.

The publication is PB 161017 *A Bibliography on Gas Lubricated Bearings—Revised*, E. B. Sciulli, The Franklin Institute, 107 pages, price $2.50. Write OTS, U. S. Dept. of Commerce, Washington 25, D. C.

Timken France builds

CANTON, OHIO—Timken France, a division of The Timken Roller Bearing Co., will build a new 15,000-sq.-ft. shipping center at its plant in Colmar, France. It will be patterned after Timken's Bucyrus, Ohio, shipping center, one of the most modern in industry.

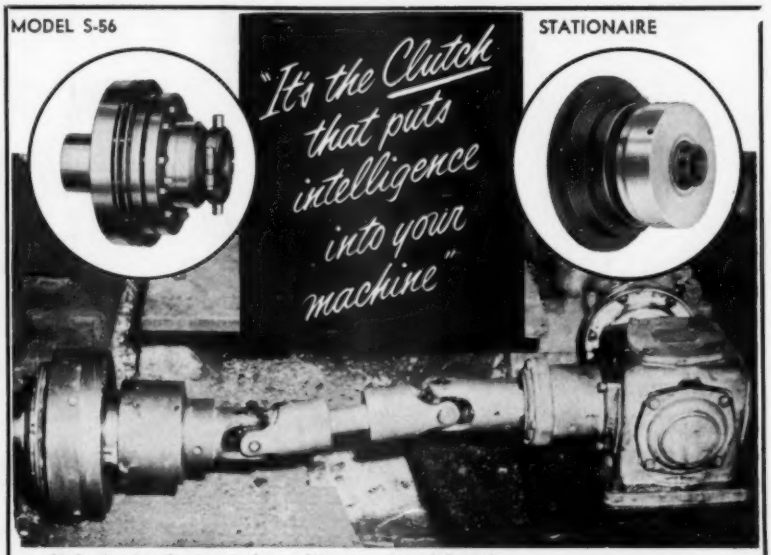
Franklin Electric to build another addition

BLUFFTON, IND.—Franklin Electric Co., Inc., producer of application-engineered electric motors, has completed plans for a new addition to its plant space. The expansion will add 24,000 sq. ft. of floor space and is expected to be completed by August. It will give the company a total manufacturing area of about 175,000 sq. ft.

The new area will extend 120 ft. south of last year's construction and will consist of four bays, each measuring 30 by 200 ft. When intervening walls have been removed, it will form part of the main plant.

William Haifley, manager of planning, points to continually increasing production as the reason for the new construction. Last year, Franklin increased the size of its property to 46 acres for future expansions.

continued on page 58



At last, steady operation without a breakdown!

The Pollak Steel Company, Marion, Ohio had a tough time keeping this operation moving without exasperating, expensive, time-killing breakdowns all too often. But now . . .

A CONWAY CLUTCH IS KEEPING THINGS MOVING FAST, SAFELY, ECONOMICALLY

Manually with Model S-56 By remote control with Model 858 Stationaire,

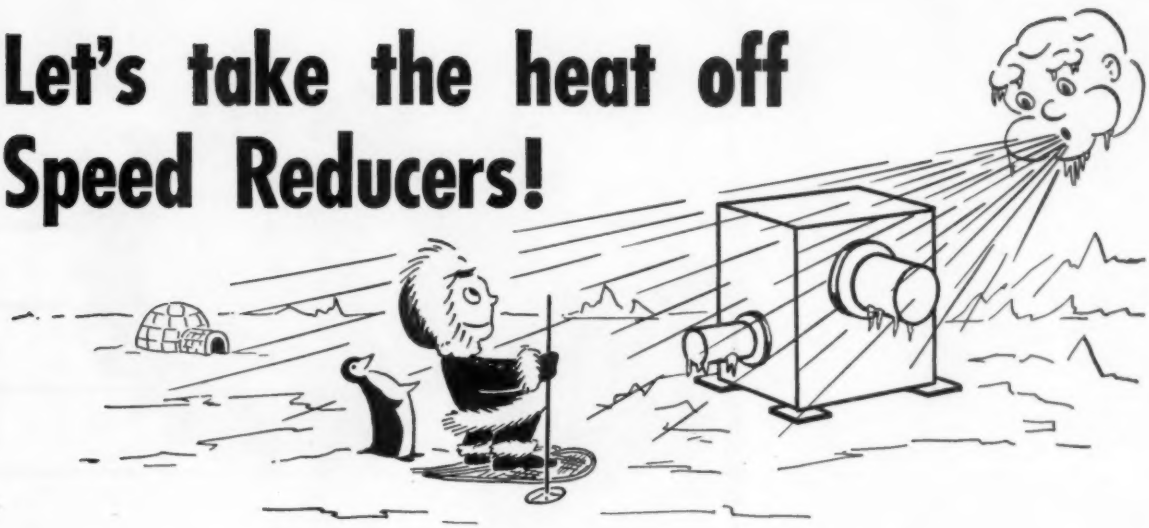
Write us how to gain "Safety through intelligent control."

The CONWAY CLUTCH COMPANY

2754 COLERAIN AVE. CINCINNATI 25, OHIO

Circle No. 10 on Reader Service Card

Let's take the heat off Speed Reducers!



A worm gear speed reducer is one of the toughest little customers in captivity. It reduces speeds day-in, day-out, with little complaint. While it works long and hard, it has limitations—set by ratio, center distance, RPM, mechanical and thermal HP ratings, etc. And, depending upon how precisely it was selected and fitted to the job requirements, it will do what it has to do.

But sometimes it's forced to play outside of its league. It must cope with job requirements that vary from here to there—normal 8 to 10 hour service without recurrent shock, the same length of service where there is some shock loading, continuous low-speed service and almost countless others. But the thing that really puts the pressure on reducers, the thing that's lurking in *every* set of job requirements—is h-e-a-t.

When you exceed the thermal capacity of a reducer for more than an hour or so, excessive temperature thins the lubricant resulting in wear; material, bearing and oil seal failures; etc. Of course, the proper lubricant will help but it can't cure the continuing problem of excessive heat.

So how can we lick this toughy? One way is to build the reducer housing oversize, big enough to radiate the heat away and keep temperatures down. But this type sticks out in aisles, louses up compact designs and barks shins. Then, we might try a smaller housing complete with fins on it to dissipate the heat. If this still doesn't work, another trick is to use a reducer with capacities and ratings a step above the ones we need. This is sending a man to do a boy's job. It's impractical, inefficient and costly. There *has* to be an easier, better, saner and cheaper way to do it. And there is!

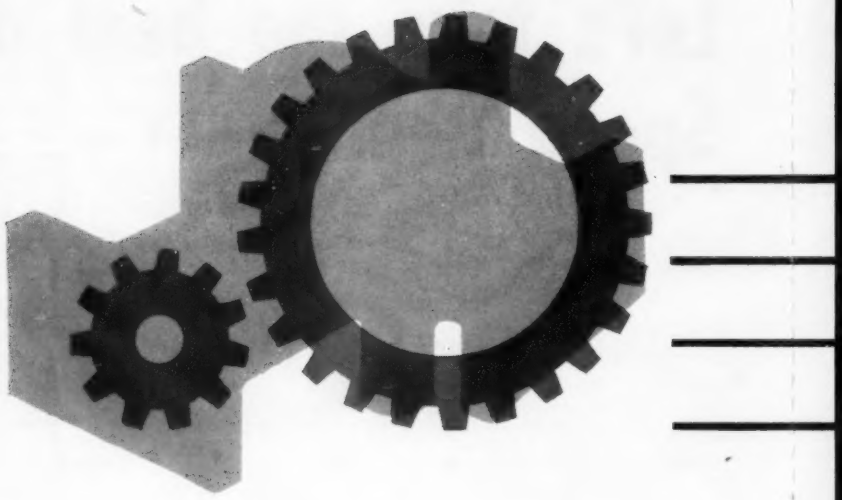
In certain cases, where the size and type of reducer permits and where we can gain enough in thermal HP rating to keep heat generation in bounds, Cone-Drive Gears does it with fan-cooling.

What's that? Simple. Just add a fan to the worm shaft plus the necessary air shields, fan cover, etc., and presto!—heat is no longer a problem. The air shields direct the fan-pushed air over the fins on the lower portion of the reducer. The fins are shaped and spotted to guide the air stream where it is needed. Thermal HP ratings are boosted tremendously, as high as 147% above those of standard reducers in some cases! Those over-worked, over-heated reducers will now do the job you bought them to do.

Other advantages? They're here in abundance. The size of the reducer stays the same. All parts on a Cone-Drive fan-cooled reducer are 100% interchangeable with parts for standard reducers. Oil capacity is identical. Shields are quickly removed without disconnecting the reducer. (This is important where severe operating conditions make periodic cleaning necessary). The reducer can also be operated *without* fan-cooling just by taking off the fan and shields.

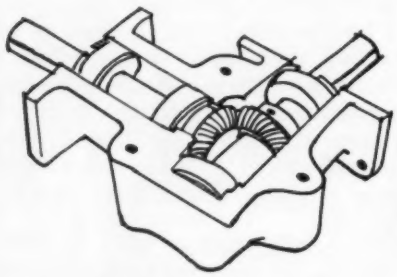
This simple addition to standard Cone-Drive HU speed reducers might be just your answer—might save you some money. Write for Cone-Drive's Bulletin CD-218. It will tell you all about the full line of Cone-Drive double-enveloping worm gear reducers as well as the fan-cooled kind. Cone-Drive Gears, Div. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

Circle No. 9 on Reader Service Card

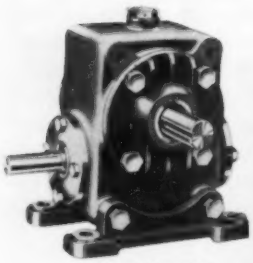


Specify enclosed gearing—for

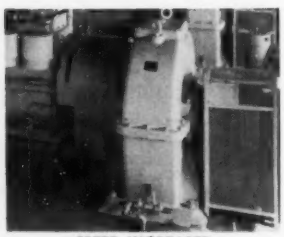
Gear boxes, transmissions, differentials and power take-offs



RIGHT ANGLE GEAR BOX



SPEED REDUCER



SPEED INCREASER

DIFFERENTIAL

Enclosed gearing is divided in four basic categories. They are: gear boxes, transmissions, differentials and power takeoffs. There are eight basic types in the four categories. Three are in the gear box category—speed reducers, speed increasers and right angle boxes. Three are in the transmission category—manual-shift transmissions, power-shift transmissions, and automatic transmissions. The remaining two are the differential and the power take-off.

A transmission is a sophisticated gear box. It differs in that it has speed and/or direction changeability. The word gear box denotes gears are used. The word transmission is confusing in that gears aren't necessarily used—such as a hydraulic transmission. This accounts for the confusion with types of transmissions. Transmissions can be gear drives or non-gear drives.

Differentials are specialty gear drives to divide power. Power take-offs are transmissions of a sort and may or may not have speed and direction adjustability.

Gears used are spur, helical, double-helical, worm, double-enveloping worm, bevel, spiral bevel, hypoid, spiroid, or other.

Gear drives range from very small to very large. Ratings range from a few in-oz to many hundred horsepower. Reduction ratios range from 1:1 to many hundred to one. Increaser ratios have lower ranges because of the extreme size of the power source needed to provide torque.

TO REDUCE SHAFT SPEED ↓

. . . . INCREASE IT ↑

. . . . REVERSE IT ←

. . . . OR CHANGE ITS DIRECTION ↱

highest efficiency and longest life

Enclosed gearing is made for every purpose

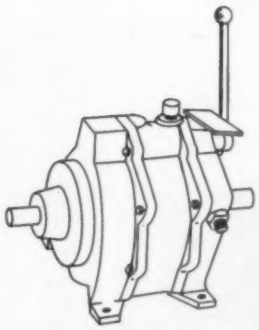
NO POWER DRIVE is more efficient than a good enclosed gear drive. Operating efficiency of 98%-99% is as high or higher than the efficiency of any other type of drive. However, efficiency varies with tooth form and direction; but it also varies with other types of drives under the same conditions. Gearing efficiency for any type operation can always be depended upon to equal the best. A good thumb rule is that you can't beat a good gear drive.

The categories of enclosed gear drives are the largest in the power transmission field. The variations of sizes, types, horsepowers, configurations, gears, speeds, etc., is almost endless. This leads to confusion for the user and retards efforts toward standardization . . . but it does provide very broad selection. Performance ratings and design of gears have been carefully established by the industry for many years. However, more envelope standardization—such as has been accomplished with motors—would be desirable.

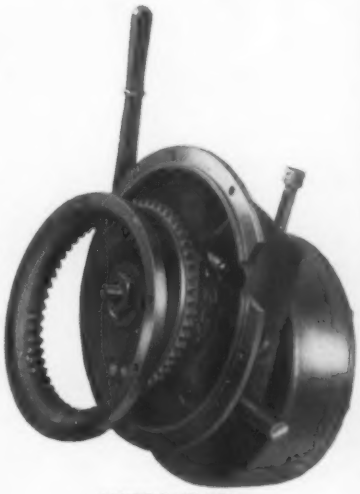
Speed reducers are the largest category of gear boxes in industry. They are often called gear reducers.

Load classifications for helical, double-helical, bevel, bevel-helical and bevel-double-helical reducers are covered by the American Gear Manufacturers Association's AGMA 151.01. This standard assures that you can select the right reducer for any type service. Your favorite manufacturers can give you this data.

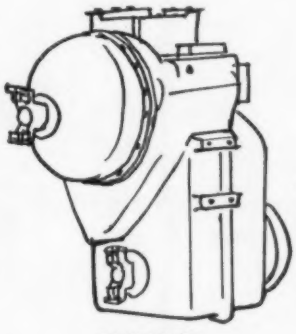
Load classifications for all types of applications are



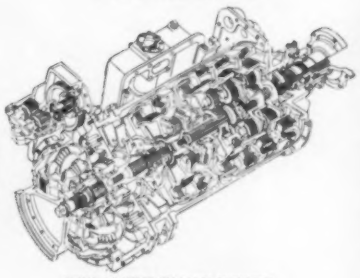
MANUAL-SHIFT TRANSMISSION



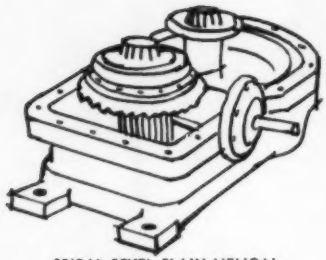
POWER TAKE-OFF



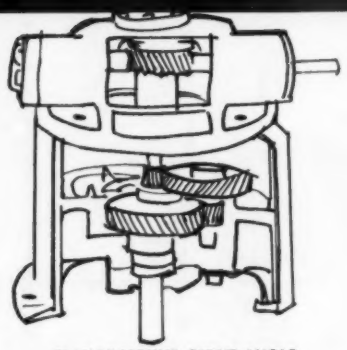
POWER-SHIFT TRANSMISSION



AUTOMATIC TRANSMISSION



SPIRAL BEVEL PLAIN HELICAL

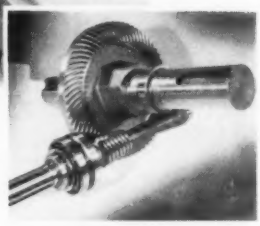


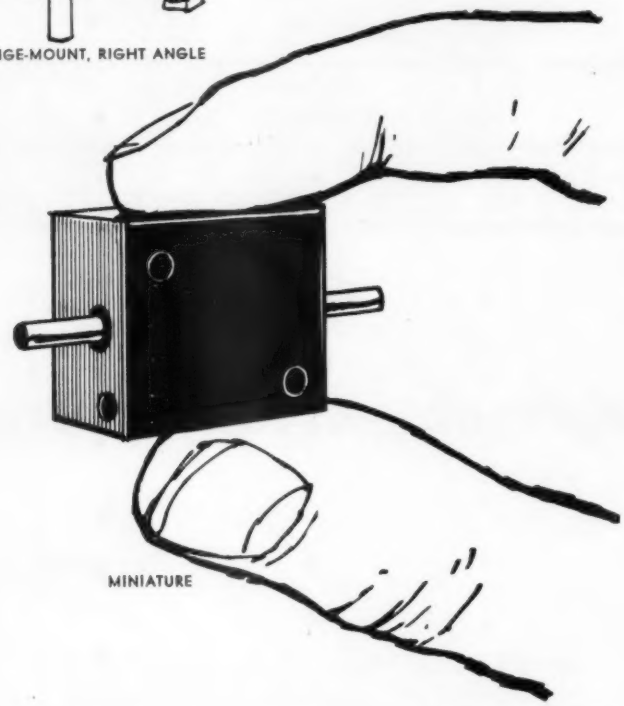
FLANGE-MOUNT, RIGHT ANGLE

DUAL OUTPUT WORM

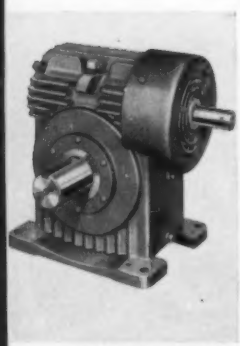
ANY KIND OF GEAR...
ANY KIND OF GEAR CASE

HIGH-SHOCK-RESISTANT

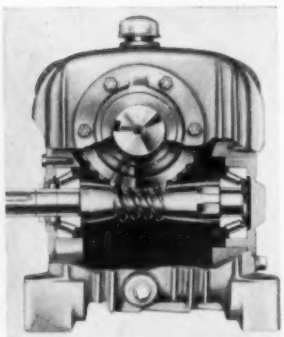




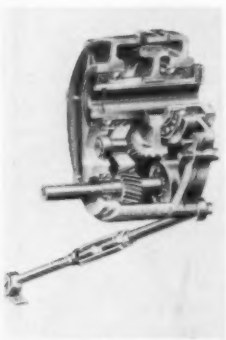
MINIATURE



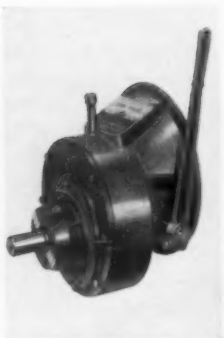
FAN-COOLED WORM



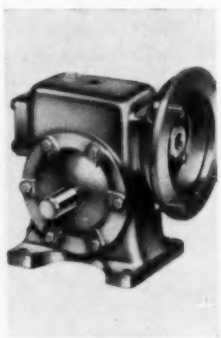
DOUBLE-ENVELOPING WORM



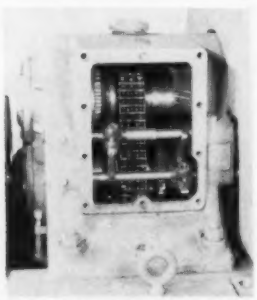
SHAFT-MOUNT



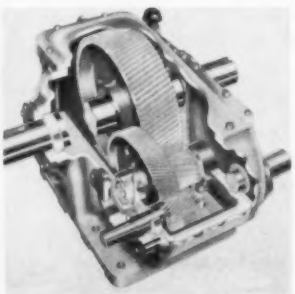
POWER TAKE-OFF



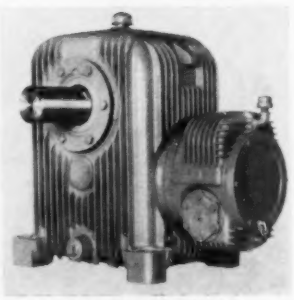
FLANGE ADAPTER



REDUCER-INCREASER, CHAIN REVERSE



TAPERED ROLLER BEARINGS



TWO SEPARATE WORMS

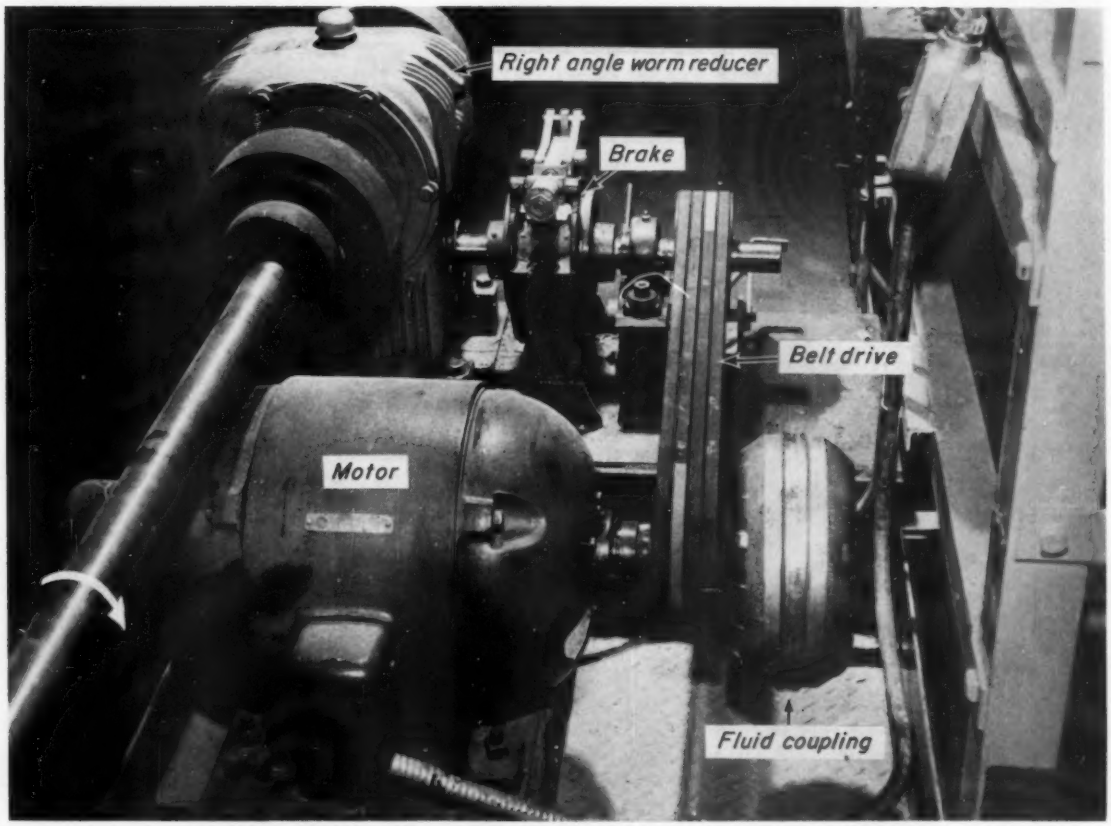
shown in tables. Machines are listed as having uniform, moderate shock or heavy shock loads. As an example, if you want to select a reducer for a centrifugal compressor, you would need one with heavy shock rating; for a centrifugal blower, one with uniform shock rating.

Service factors are differentiated for different prime movers. This is because motors and engines have different effects on reducer life.

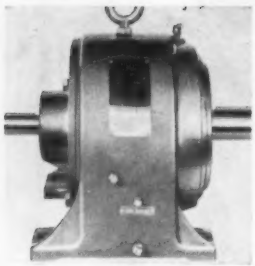
Load classifications for shaft-mounted reducers are covered in AGMA 152.01. All types of machines on which they can be applied are listed and referenced as to uniform shock, moderate shock or heavy shock. In addition, a service factor for daily hours of operation is shown (10 or 24 hr service). Again, check your favorite manufacturers catalogs.

Helical and double-helical reducers are covered in AGMA 271.02. This standard defines and establishes reduction ratios. Tables of ratio tolerances for numbers of reductions are shown and a complete list of ratio series. The series is compatible with the gearmotor series so that the two can be calculated on the same basis.

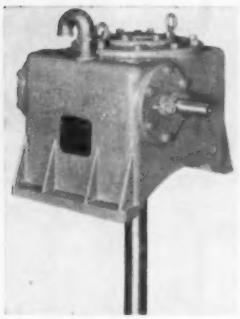
COOLING TOWER FAN drive is exposed to weather in oil refinery; hydraulic motor connects to worm reducer.



15-HP MOTOR opens 47-ton jet bomber hanger doors. Double enveloping worm reducer with extended output drives six drum hoists that operate doors by cable.



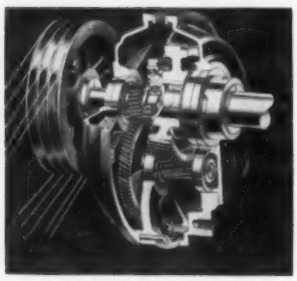
CONCENTRIC SHAFTS



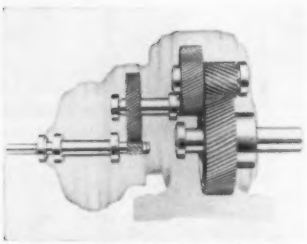
33:1 WORM

AUTOMATIC OVERLOAD RELEASE

ANY KIND OF GEAR...
ANY KIND OF GEAR CASE

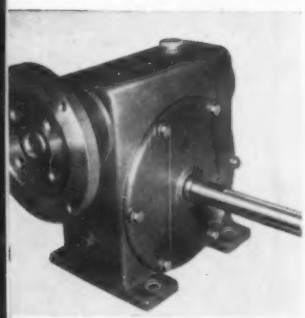


COMPACT SHAFT MOUNT

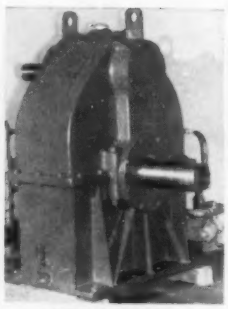


SLOW SPEED, TRIPLE REDUCTION

PLASTIC CASE, NYLON GEARS

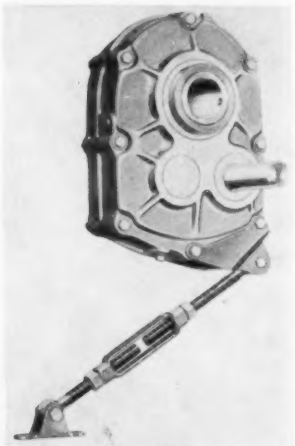


TYPE "C" MOUNTING FACE

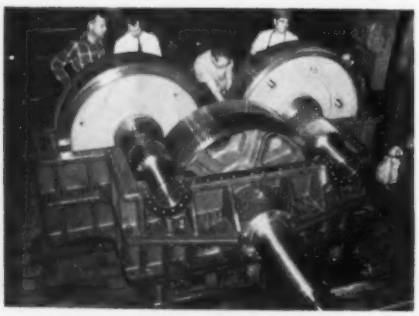


VERTICAL-OFFSET

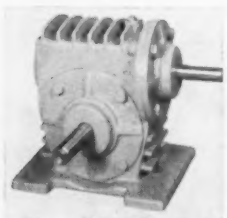
SPIRAL BEVEL SHAFT-MOUNT



SHAFT-MOUNT



KING-SIZED



HORIZONTAL, RIGHT ANGLE

Service factors and ratings of helical and double helical reducers are covered in AGMA 420.02. This standard covers reducers and increasers whose pitch line velocities are less than 4000 ft per min and whose pinion speeds are less than 3600 rpm.

Equivalent horsepower must be calculated before selection by multiplying specific or actual horsepower by a service factor. The reducer must have a capacity equal to or in excess of the equivalent horsepower. Recommended service factors are listed.

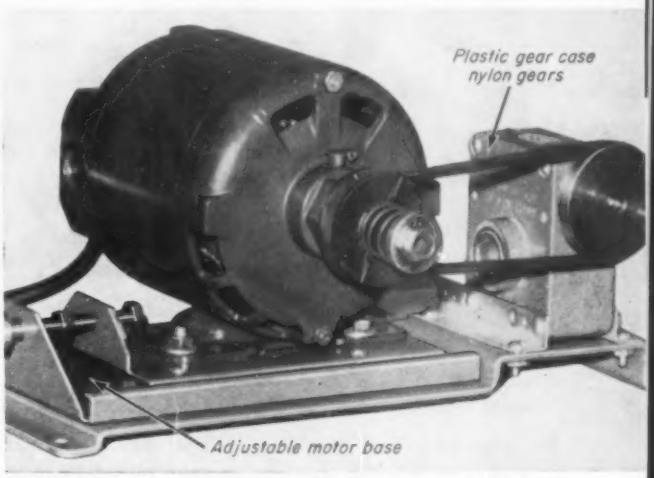
Where the actual or momentary starting load exceeds 200% normal (100% overload), the equivalent horsepower is obtained by dividing the maximum momentary load by 2. If this value exceeds the value for equivalent horsepower obtained by figuring service and duty, it must be used.

Where motors are equipped with brakes and torque rating of the brake exceeds rating of the motor, the rating of the brake must be used.

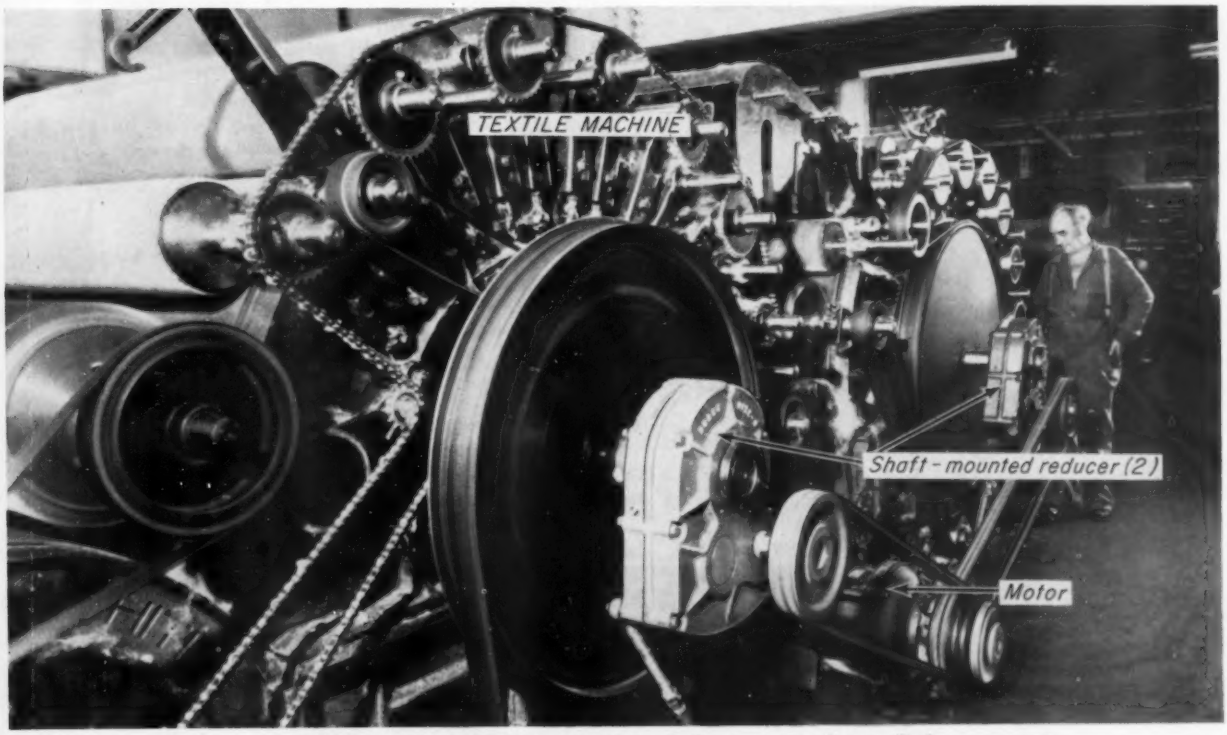
High speed helical and double-helical reducers (parallel shaft type) are covered in AGMA 421.04. This includes units with pinion speeds of 3600 rpm and higher with pitch line speeds of 4000 ft per min and higher, or journal velocities of 1500 ft per min or higher. This does not include marine propulsion units.

Tables are shown for calculating tooth height, pressure angles, working depths and helix angles. Load classifications as to type service are also shown.

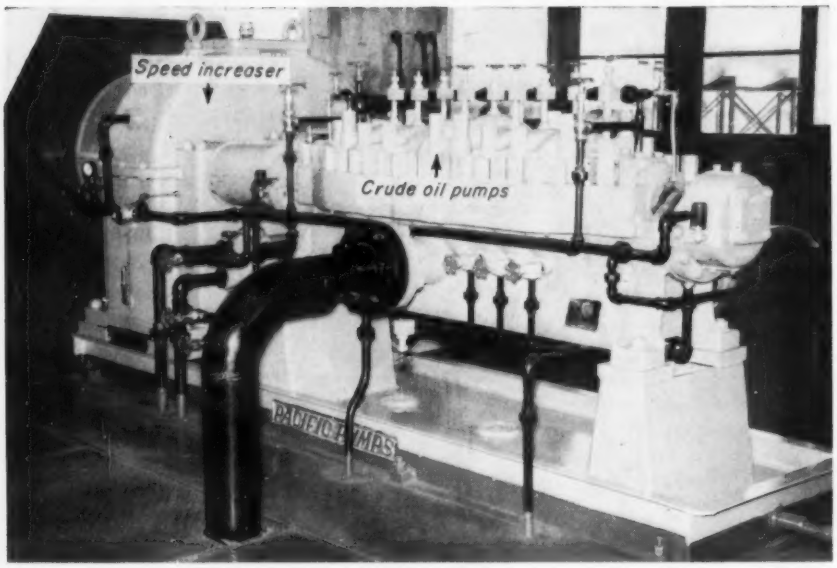
Helical and double helical reducers for oilfield pumping units are covered in AGMA 422.02. This standard is separate on the basis of peculiar and non-uniform nature of the loading and large number of gears used in the industry. Peak



FRACTIONAL MOTOR is mounted integrally with reducer with plastic case and Nylon gears. Light weight, long life are afforded with no lubrication problems.



TEXTILE MACHINES are powered by shaft-mounted reducers. Reducers mount onto shaft extensions, can be easily removed, permit accessibility for maintenance.



LARGE OIL PUMP is powered by gas engine through speed increaser. Engine speed delivers maximum torque in this fashion.

ENCLOSED GEARING *continued*

torque ratings are listed and are reprinted by arrangement with the American Petroleum Institute (API).

Spiral bevel, combination spiral-bevel-helical and spiral-bevel double-helical reducers are covered in AGMA 430.02.
This standard is for reducers and increasers where pitch line velocities are less than 400 ft per min, and where pinion speeds are less than 3600 rpm. It is also applicable to single-reduction reducers of the spiral-bevel type and double and triple-reduction units in which bevel gears are used for the first reduction; and helical or double-helical for the second and third reductions.

Before a reducer can be selected, equivalent power must be computed by multiplying the specified or anticipated power (not rating of the motor or prime mover) by the factor for the class of service for which the reducer is to be used. It is necessary that the reducer have a capacity equal to or in excess of the equivalent power.

If the actual, maximum momentary starting load exceeds 200% of equivalent power, equivalent power must be re-evaluated by dividing maximum momentary load by 2. If the motor is equipped with a brake, and torque rating of the brake exceeds rating of the motor, rating of the brake dictates the selection of the reducer.

Service factors for different prime movers (motors, different engines) are listed for type of shock and hours of service per day. Allowable overhung loads are based on weakest shafts, bearings or bolts. The load limit is based on load being applied at the approximate center of the shaft extension.

The theoretical load on the high speed or low speed shafts due to chain, pinion or belt must be multiplied by the following factors to get actual shaft load:

Chain	1
V-belt	1½
Pinion or double chain	1½
Flat belt	2½

Actual shaft load must not exceed the calculated value.

Single and double-reduction cylindrical-worm and helical-worm reducers are covered in AGMA 440.03. Applications are limited to worm speeds of 3600 rpm and less, and sliding velocities of 6000 ft per min or less. The power rating formula for worm gearing applies to ratios from 3:1 to 100:1 inclusive.

The rating formula applies for continuous service which is free of recurrent shock loading and where total duration is up to 10 hr per day. Normal starting or momentary peak loads up to 300% of the rating are permitted.

Input power rating of the reducer is affected by several factors in addition to the rating of the gearing. Additional power, equivalent to that lost in oil churning, bearings and seals, must be supplied.

Power rating also may be limited by ability to dissipate heat at such a rate as to maintain bulk oil temperature at a reasonable level. Where oil temperature does not exceed 100 F above ambient, the reducer input power rating is

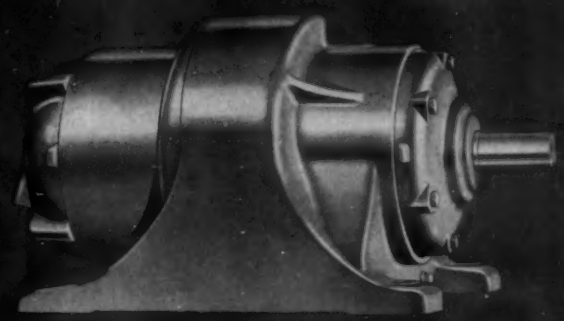
$$P_r = P_l + P \quad \text{.....(1)}$$

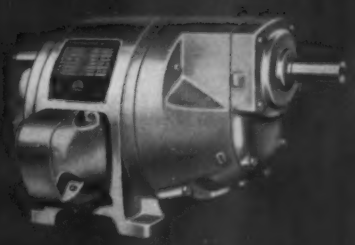
Power loss (P_l) may be determined experimentally as the no-load power input to the reducer, filled to correct level with recommended lubricant, and operating at rated speed and anticipated temperature. Input power to gearing mesh (P) is determined by formula.

Should the power rating result in a temperature of lubricating oil exceeding 100 F above ambient, a limiting thermal power rating must be applied. This rating may be determined by test as the input power which results in a temperature rise of 100 F above ambient.

Input power rating of double reduction units may be determined by considering the two reductions to be separate, connected in series.

Power rating of the second reduction is related to





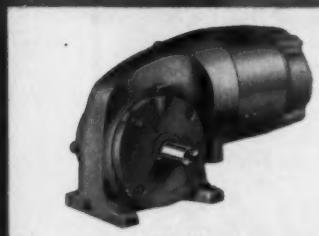
TYPE GH
SINGLE REDUCTION SYNCROGEAR
1/3 TO 30 H.P.

TYPE GR
SINGLE REDUCTION SYNCROGEAR
1/3 TO 30 H.P.

whatever you need in geared power... whatever the speed...whatever the horsepower...specify

U.S. Syncrogear...now with gears honed to super finish!

Again U.S. introduces a new first in gearmotor design: Gears *honed to super finish* for quiet, smooth running and longer life. A long succession of Syncrogear innovations by U.S. during the last 25 years have been widely adopted. **Through-hardening** of gears... the **solid-shank pinion**... the sturdy **"pyramidal" base**... **micro-shaving** of gears... solid cast **one-piece case**..."crowned" helical gear teeth of **elliptoidal design**... all these add years of trouble-free operation to Syncrogear life. To assure precision, U.S. makes its own gears. For more information on U.S. Syncrogear features, send for free color brochures: Syncrogear Bulletin No. F-1880, Right-Angle Worm-Gear Syncrogear Bulletin No. F-1650, or Shaftmount Syncrogear Bulletin No. F-1994.



TYPE GW
RIGHT-ANGLE, WORM-GEAR
SYNCROGEAR
1/3 TO 2 H.P.

TYPE GDV
VERTICAL SYNCROGEAR
3 TO 30 H.P.

U.S. ELECTRICAL MOTORS INC.

P.O. Box 2058 • Los Angeles 54, California, or Milford, Connecticut

Circle No. 49 on Reader Service Card

TYPE GM
TRIPLE REDUCTION SYNCROGEAR
1 TO 10 H.P.

TYPE GDF
MOTOMOUNT SYNCROGEAR
1 TO 60 H.P.

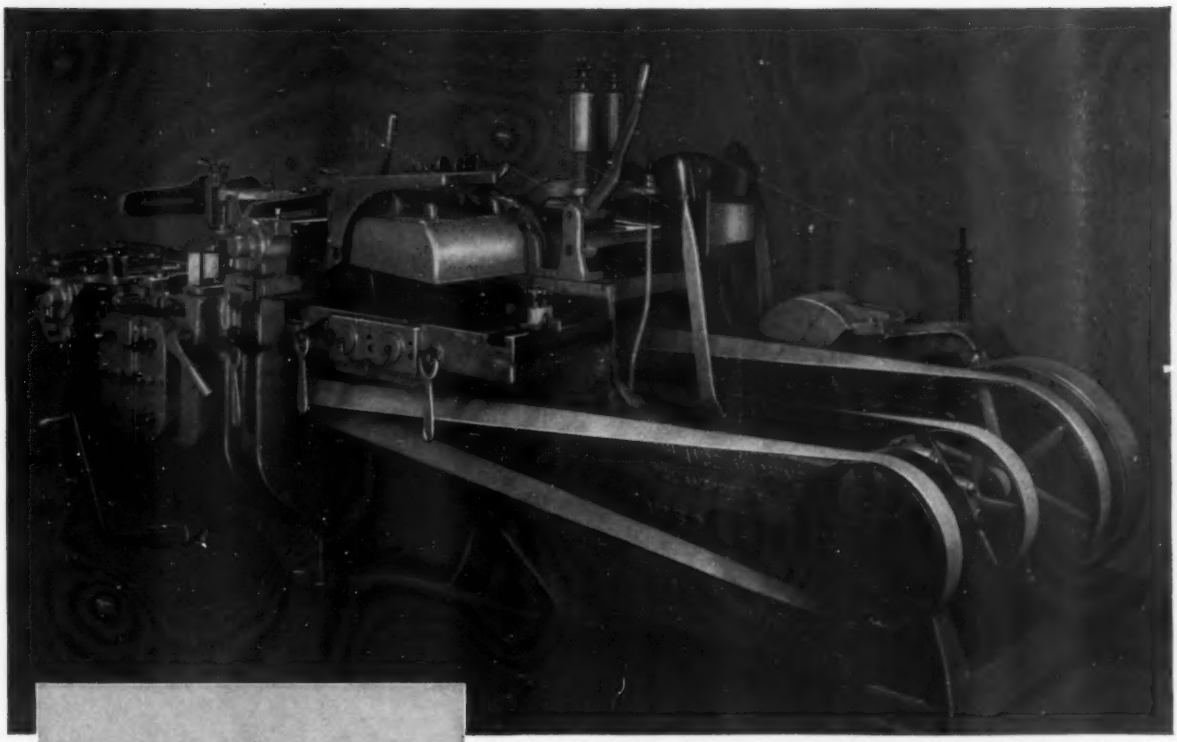
TYPE GC
SHAFTMOUNT SYNCROGEAR
1/4 TO 40 H.P.

the input shaft of the double reduction by applying efficiency of the first reduction. Rating of the total unit is either the input rating of the first reduction or the rating of the second reduction related to input shaft whichever is the smaller. Input power rating to a double reduction unit may be limited thermally.

Factual determination of efficiency of a speed reducer must take into consideration all losses—not just

Enclosed gear drive manufacturers

Abart Gear & Machine Co.
Acme Gear Company
The Adams Company
Advance Gear & Machine Corp.
Air Associates, Inc.
Airborne Accessories Corp.
Alling-Lander Co., Inc.
The Louis Allis Company
Allis-Chalmers Manufacturing Co.
Allison Div.
General Motors Corporation
Alten Foundry and Machine Works, Inc.
Amarillo Gear Works, Inc.
The American Pulley Company
American Stock Gear Div.
Perfection Gear Company
Amgears, Inc.
The Auto Engine Works, Inc.
Lycoming Div.
Avco Manufacturing Corp.
Axelson Manufacturing Co.
Bedford Gear & Machine Products, Inc.
Bethlehem Steel Co.
Supply Division
Bodine Electric Co.
Charles Bond Company
Boston Gear Works
Bowmar Instrument Corp.
Braden Winch Co.
Brad Foote Gear Works, Inc.
Breeze Corporation
Brevel Products Corporation
Chicago Electric Co.
Christiana Machine Co.
J. D. Christian Engineers
The Cincinnati Gear Co.
Cleveland Worm & Gear Co.
Cone Drive Gears Div.
Michigan Tool Co.
Continental Gin Co.
The Crichton Co.
Equipment Div.
Crofts, U. S. A., Inc.
Crown Gear
Subsidiary of Harrington & Richardson, Inc.
DeLaval Steam Turbine Company
Denver Equipment Co.
Dodge Manufacturing Corp.
Doerr Electric Corp.
Dorris Company
Chas. Drexler Co., Inc.
Dynamic Gear Co.
The Earle Gear and Machine Co.
Electric Motor Corp.
Div. of Howard Industries, Inc.
Euclid Universal Machine, Inc.
Fairbanks, Morse & Co.
The Falk Corporation
Farrel-Birmingham Company, Inc.
Federal Seal & Gear Corp.
Foote Bros. Gear & Machine Corporation
Fort Worth Steel & Machinery Co.
Franke Gear Works, Inc.
Franklin Electric Co., Inc.
Harry Frohman, Inc.
Funk Mfg. Co.
Ganschow Gear Company
Gear Specialties, Inc.
Gear Systems, Inc.
General Electric Company
Gerotor May Corp.
Globe Industries, Inc.
Grant Gear Works, Inc.
Great Eastern Manufacturing Inc.
Hamilton Gear & Machine Co., Ltd.
Hewitt-Robins, Inc.
The Horsburgh & Scott Co.
Houston Equipment Co., Inc.
Illinois Gear and Machine Company
Industrial Process Engineers
D. O. James Gear Manufacturing Co.
Janette Electric Manufacturing Co.
Johnson Gear & Manufacturing Co., Ltd.
W. A. Jones Foundry & Machine Co.
Juall Gear Co.
Lima Electric Motor Co.
Link Aviation, Inc.
Sub. of General Precision Equipment Corp.
Link-Belt Co.
Lovejoy Flexible Coupling Co.
Lufkin Foundry & Machine Co.
Mansfield Brass Products Co.
Mantel Gear Works
Massachusetts Gear & Tool Co.
Div. of Geartronics Corp.
Master Electric Co.
The Medart Co.
Mentor Products, Inc.
Transmission Div.
Merkle-Korff Gear Co.
Mesta Machine Co.
Metron Instrument Co.
Morse Chain Co.
A Borg-Warner Industry
The National Gear Corp.
Div. The Brown-Brockmeyer Co.
New England Gear Works
New Process Gear Corp.
The H. W. North Co.
The Ohio Gear Co.
Ohio Forge & Machine Corp.
Oil Well Supply Div.
United States Steel Corp.
Olson Industrial Products, Inc.
Ottumwa Iron Works, Inc.
Palmer-Bee Company
Paragon Gear Works
The Parkersburg Rig & Reel Co., Inc.
Patterson Foundry & Machine Co.
Peerless Gear and Machine Co., Inc.
Perkins Machine & Gear Co.
Philadelphia Gear Corp.
PIC Design Corp.
Pittsburgh Coal Washer Co.
Poole Foundry & Machine Co.
Precision Gear Div.
Perfecting Service Co.
Precision Mechanisms Corporation
Quaker City Gear Works
Rampe Manufacturing Co.
Reef Industries, Inc.
Rockford Clutch Div.
Borg-Warner Corp.
Rockwell-Standard Corp.
Transmission and Axle Div.
Saginaw Steering Gear Div.
General Motors Corp.
The Sandy Hill & Brass Works
Sargent Engineering Corp.
Shepard Niles Crane & Hoist Corp.
Simonds Gear Manufacturing Co.
The Snow-Nabstedt Gear Corporation
Spiroid Div.
Illinois Tool Works
Steel Products Engineering Co.
Stephens-Adamson Mfg. Co.
Sterling Electric Motors, Inc.
Stranahan Gear Co.
The Terry Steam Turbine Co.
Timing Gear Corp.
Transmission & Gear Co.
Turner Transmissions
Twin Disc Clutch Co.
United Electric Machinery Co.
United Engineering & Foundry Co.
U. S. Electrical Motors Inc.
Universal Gear Corp.
Universal Gear Div.
Novo Pump & Engine Co.
Vard, Inc.
Sub. of Royal Industries, Inc.
Wagner Electric Corp.
Warner Automotive Div.
Borg-Warner Corp.
Watson-Flagg Machine Co.
Western Gear Corporation
Westinghouse Electric Co.
Winsmith, Inc.



No-stretch Texalon nylon core synthetic belting on new Moulder for the woodworking industry, built by Hermance Machine Co., Williamsport, Pa.

How "no-stretch" Texalon cuts power transmission costs

With Texalon, the new nylon core synthetic belting by Rhoads, you get a smooth, uniform flow of power regardless of shock loads. No belt adjustments are required. Laps easily in minutes.

Texalon increases production by preventing unscheduled shutdowns. Permits faster driven speeds and a wide variety of speed changes. Texalon belts are economical for almost any mechanical power transmission requirement, including the replacement of V-belts and other type flat belts.

At Rhoads, an experienced belt drive engineer recommends the flat belt that is exactly right for your operating conditions. It may be Texalon. It may be Tanastic, the nylon core leather belting. Or it may be Tannate, famous leather belting. Bulletins on request.

Address Engineering Department, J. E. RHOADS & SONS
2100 W. 11th Street, Wilmington 99, Delaware

RHOADS

Established 1702 . . . Pioneers in Mechanical Power Transmission
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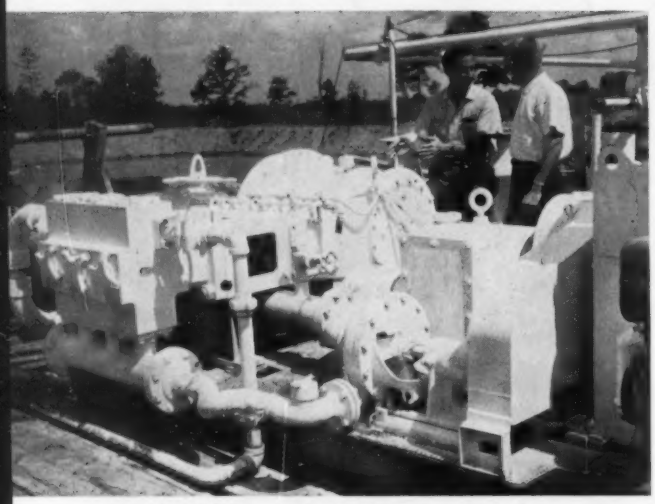
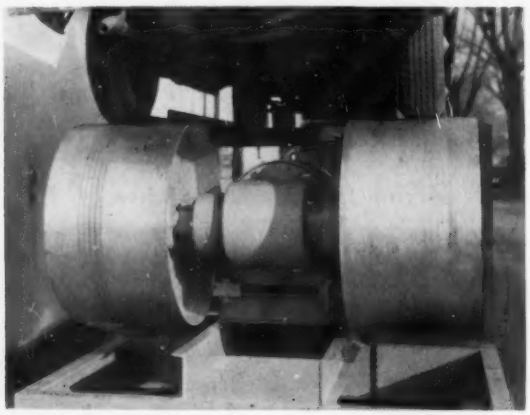
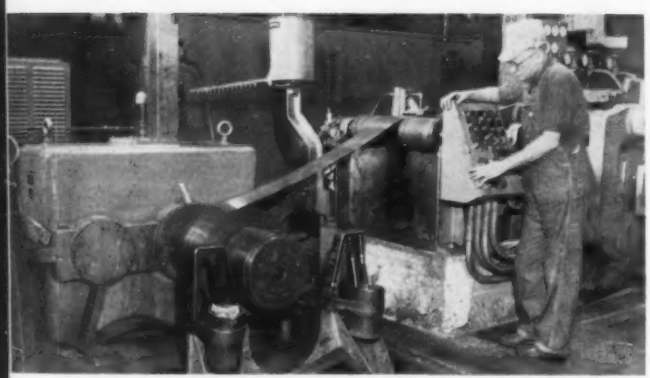


TWIN DIESEL engines drive through 420 hp reducers to operate rotary slush pumps on rotary rig in oil field.



DOUBLE-ENDED REDUCER carries two 40-in. dia rolls for dynamometer test on cars up to 100 mph.



STRIP STEEL rewind machine has push button control. Drive motor powers spindle through heavy duty double-helical reducer.

the loss at gearing mesh. Efficiency for a wormgear reducer transmitting rated power can be calculated as follows:

Power loss at the gearing mesh is expressed by the second term in the equation for P,

$$P = \frac{W_t D n}{126{,}000\, m_G} + \frac{v W_f}{33{,}000} \qquad (2)$$

Combining this with the power loss in reducer components (P_l) provides total loss.

The overall efficiency, in percent, of the speed reducer can then be determined from the equation

$$\eta = \frac{P_r - \left(\frac{v\ W_f}{33{,}000} + P_l\right)}{P_r} \times 100 \qquad (3)$$

Where

D = pitch diameter of gear, in.
m_G = gear ratio
n = speed of worm, rpm
P = input power to gear mesh, hp
P_l = power loss of components other than gears, hp
P_r = input power to reducer, hp
W_f = frictional force, lb
W_t = tangential load on worm gear teeth, lb
v = sliding velocity, fpm
η = efficiency, per cent

Double-enveloping worm reducers are covered in AGMA 441.02. This standard covers reducers of single and double-reduction types. The housings are of the box type rather than styled to follow the contour of the gearing. This minimizes agitation of the lubricant and provides strength to hold the gearset in alignment under load.

When a chain, gear or belt drive is mounted on the input or output shaft, the overhung load is calculated as a force acting tangent to the pitch circle of the mounted member. One of the following factors should be used.

Chain	1.00
Pinion gear	1.25
V-belt	1.50
Flat belt	2.50

The following thermal rating formula limits the input horsepower to such a value that the temperature rise of the oil bath will not exceed 100 F above ambient.

$$P = A\ K_T$$

Oil bath temperature should not exceed 200 *F*.

Thermal horsepower rating formula is applicable at worm speeds up to 3600 rpm or 4000 ft per min. A force feed lubricating system must be provided where worm speeds exceed 2000 feet per minute. Auxiliary cooling must be provided where mechanical horsepower rating is in excess of thermal rating, if full advantage of the available horsepower capacity is to be realized.

FRANKLIN ELECTRIC

FOR

GARAGE DOORS
VENTILATORS
INDEX TABLES
MACHINERY
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GEAR-O-MATIC

INSTANT-REVERSING MOTOR

DEPENDABILITY for stop-go, forward-reverse motion with full power, high-torque start. Operable manually, by built-in limit switches, or as automation requires. SAFETY assured with automatic, instant reversal when driven product meets predetermined resistance. ECONOMY as a low cost packaged operator unit ... quick and easy to install or integrate with your product or system.

POWER-FULL GEAR REDUCTION

Worm gear drive from capacitor-start Franklin Electric Motor applies full power instantly upon reversing at built-in limit switch setting.

Driven system or product may be instantly reversed at any time during forward or reverse cycle by manual or automatic switch; or by automatic operation of built-in safety device.

GEAR-O-MATIC® performs all functions typically required in radio-controlled or manual-switch garage door operation ... functions applicable to operation of many other products ... perhaps yours.

PATENTS PENDING

Integrated with the Franklin Electric Motor is a control box with 24 volt A. C. circuitry. System includes plug-in connection for radio or automation control and receptacle for light bulb or power extension line. All limit and safety reversing switch settings are adjustable.

From the Home of DEPENDABLE Electric Motors

For more data write for "FACTS ABOUT FRANKLIN GEAR-O-MATIC®"

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BLUFFTON, INDIANA

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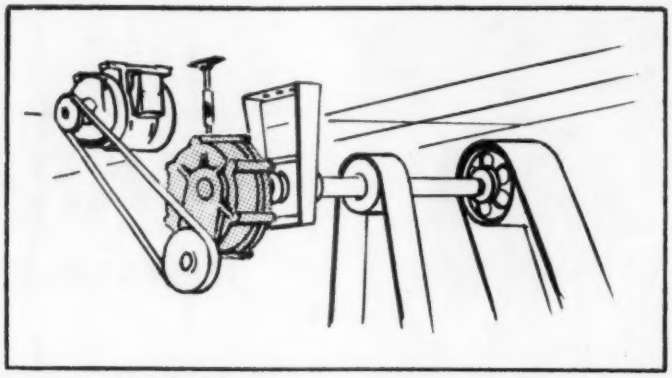


SHAFT-MOUNTED reducer mounts on end of work shaft.

Shaft-mounted reducer

THIS REPORT is compiled from figures covering approximately 3000 shaft-mounted reducer installations across the country.

The poll shows that individual installations more than doubled since 1955, a total of 103% increase. With the gains, much also has yet to be done.

TO FOSTER BETTER communications between users of power transmission products and manufacturers, the following is a report from across the nation, from all types of industries, from plants of all sizes.

Those polled include chief engineers, factory managers, product engineers, maintenance superintendents, plant engineers, master mechanics, design engineers and many others.

The poll was conducted in every geographical area throughout the country, from San Diego to Boston, Seattle to Jacksonville, Chicago, Pittsburgh and all intermediate areas.

Here is what you reported . . .

Don't Know

Great lack of information and specific data inhibits a greater use of shaft-mounted reducers. Of you polled, 58% don't use them, have none in your plant or know little about their utility.

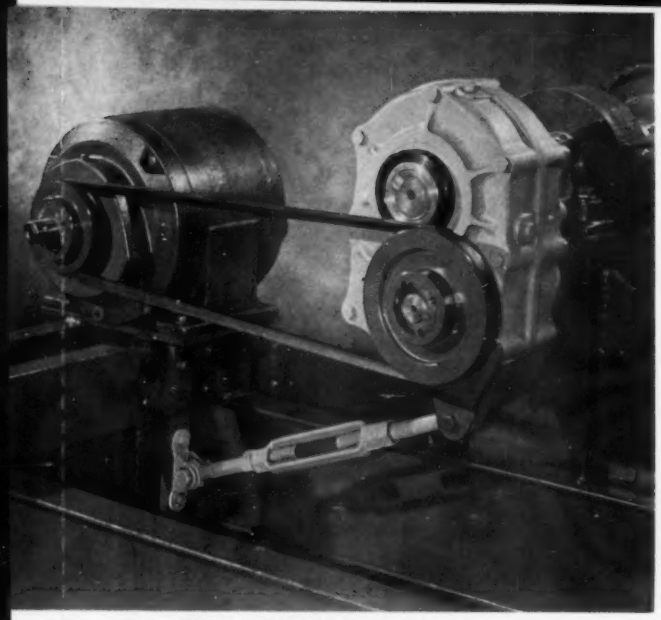
Of the 42% who use them, you offered many recommendations and cited many faults, but only 0.8% said you don't like them and refuse to use them. Conversely, 99.2% like them.

Of those who do use them, the average number is 22 installations per plant. However, when averaged over the total, it is less than 11 per plant.

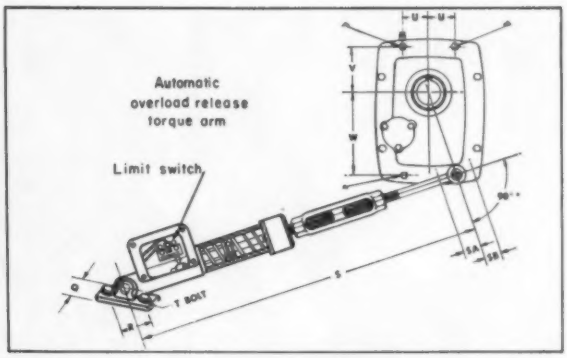
Reasons

Of the 42% who use them, here are the reasons why you selected shaft-mounts over other products, or what products you replaced by their installation.

- Approximately 58% previously had roller chain problems or selected shaft-mounts for new installations to avoid roller chain problems.
- Approximately 33.8% had shaft or counter-shaft problems that you eliminated by mounting the reducer directly on the work shaft.



BELT TENSION is controlled by torque arm.



WORK OVERLOAD trips limit switch, stops operation.

installations up 103% in 5 years

- Approximately 31% of you had V-belt problems or selected shaft-mounts to replace V-belt installations.

- Approximately 42% had open gear problems, selected shaft-mounts to replace open gears or selected them instead of renewing with new open gearing.

- Approximately 51% selected shaft-mounts to eliminate shaft couplings or problems of extra connections in which couplings would be needed.

- Approximately 7% cited other reasons, such as time saving, space saving, labor saving and others.

- Approximately 12.9% are using shaft-mounts to eliminate vibration prob!ems previously encountered with other type of drive equipment.

- Approximately 33% of you selected shaft-mounts because of the lower first cost after pricing the equivalent components otherwise needed.

- Approximately 29% of you say that operating costs are less than with other products previously used.

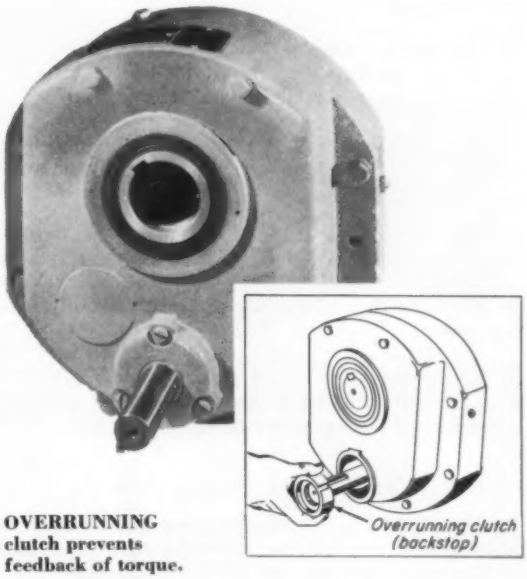
- Approximately 51% say you have cut maintenance problems as a result of installing shaft-mounts.

- Approximately 29% say that conditions of safety warranted switching to shaft-mounts or that the installation solved a safety problem that previously existed.

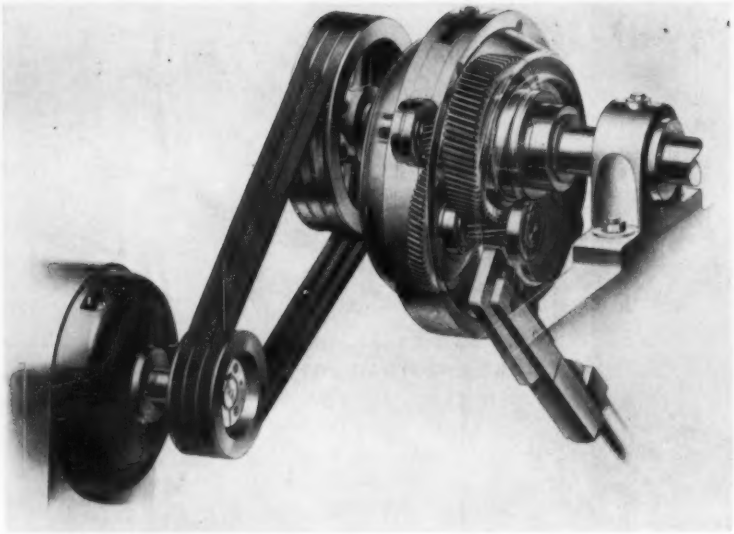
- Approximately 21% comment on the reduced amount of stock items required, such as couplings, sheaves, sprockets, pillow blocks and other items not needed because of the less complex mounting.

Problems

- Approximtely 53% of you cited problems of one



OVERRUNNING clutch prevents feedback of torque.



HELICAL GEARS provide strong, trouble-free life. Split tapered bushing with locking collar holds reducer on shaft.

SHAFT-MOUNTED REDUCERS *continued*

sort or another with shaft-mount installations. Most of the problems fall into a pattern. Some of the problems exist only on one or two makes of reducers and not on the general line.

- Approximately 24.4% of you complained of oil leaks and dripping caused by faulty seals. Seal replacement was mandatory for continued service.

- Approximately 13.7% complained of bearing failure in excess of what was expected. Failures may or may not have been the fault of the bearings themselves. Failure could have resulted from loss of lubricant but the differentiation is not tabulated.

- Approximately 6.5% had instances of shafts twisting or bending caused by the additional overhang and pull of the reducer on the work shaft.

- Approximately 11% of you consider your installations unstable although they are in service and working.

- Approximately 2% mentioned that your installations are dangerous.

- Approximately 11.5% of you complained of initial high cost.

- Approximately 6.5% of you had other problems such as breaking input shafts, faulty bearing retainers, non-true bushings, gear failures and keys shearing.

Don't Need Torque Arm

- Approximately 8% of you have installations on which you don't use a conventional torque arm. Some are on conveyor drives on which a torque arm is not required or is optional. However, there are a few that . . .

. . . plate-mount the reducer at right angles to the base
. . . use solid supports instead
. . . mount the reducer rigidly on a frame
. . . use a yoke instead
. . . use a bolted model
. . . fasten to solid bar

Recommendations

Approximately 32% of you had recommendations to offer manufacturers and other users. Here are some of them not in order of mention nor importance.

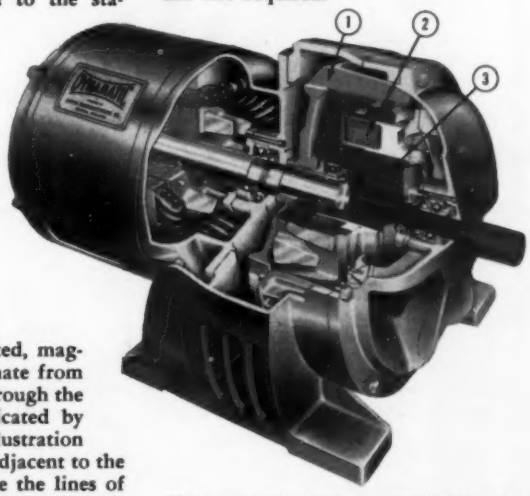
(1) Use deeper key-seats on input side, especially on smaller units.
(2) Reduce backlash in gear-train.
(3) Use larger and better bearings.
(4) Use lighter weight gears.
(5) Improve mounting design to reduce wobble.
(6) Improve hub lock to provide easier removal and reinstallation.
(7) More torque arm connections.
(8) Reduce cost.
(9) Use better oil seals (many mentions).
(10) Standardize configurations for make-interchangeability.
(11) Make in more stock sizes.
(12) Make smaller and lighter.
(13) Make higher ratios available.
(14) Make cases heavier to be less subject to damage.
(15) Integrate fluid coupling or slip clutch into design.
(16) Provide more heft.
(17) Make housings lighter to reduce overhung weight.
(18) Provide better instructions for guarding.
(19) Prevent unit from vibrating. ▲▲▲

HOW DYNAMATIC® Drives Provide Infinitely Adjustable Speed with AC Power

Dynamatic Ajusto-Spede® and Dynaspede® Drives operate from an alternating current power source and are infinitely adjustable from zero RPM to full output speed. Accurate control of output speed is obtained by varying the current in a single field coil.

Each Dynamatic Drive consists of a constant speed AC motor and an eddy-current coupling. Torque developed in the motor is transmitted through the coupling by electromagnetic attraction between its driving and driven members.

The driving member, or drum (1), is mounted on the end of the motor shaft and surrounds the rotor, or driven member (3). The drum is free to rotate independently of the rotor until current is applied to the stationary field coil (2).



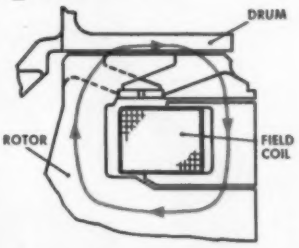
1. Input Drum Assembly
2. Stationary Field Assembly
3. Output Rotor Assembly

As the field coil is excited, magnetic lines of force emanate from the field coil and flow through the rotor and drum as indicated by arrows in cross-section illustration (A). Poles on the rotor adjacent to the smooth drum concentrate the lines of force into localized areas of "high flux" density in the drum's inner surface, shown in illustration (B). As the drum rotates about the rotor, these high flux areas sweep the inner surface of the drum, causing a variation of flux density that generates an eddy-current field in the drum's inner surface. Magnetic attraction between this eddy-current field and the rotor poles causes the rotor to rotate with the drum.

The torque transmitted from the drum to the rotor varies with the current applied to the field coil and with the "slip", or difference in speeds between the drum and rotor. Speed control with eddy-current equipment is obtained with a control system that adjusts field coil current to deliver the required torque at the desired slip.

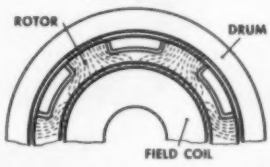
The control systems used with Dynamatic Eddy-Current Equipment operate on alternating current and require no special power source. Because of the low power required for field coil excitation, rectifying of field coil current is easily accomplished electronically. Expensive motor-generator sets are not required.

The control features available with Dynamatic Eddy-Current Equipment include constant speed regulation, acceleration control, torque regulation, cascading of multiple units, inching and threading, and numerous others as required by individual applications. Dynamatic Eddy-Current Equipment is ideally suited to automatic control.



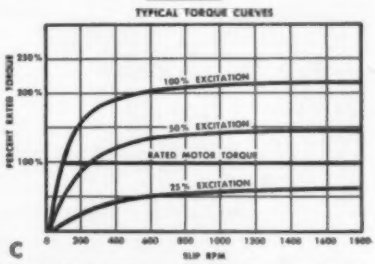
A

Flow of magnetic lines of force through rotor, drum, and stationary field.



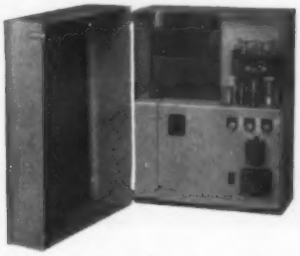
B

Concentration of magnetic lines of force by the rotor poles.



C

Typical torque curves show torque at various values of excitation. The horizontal line is rated motor torque.



D

The electronic control systems used with Dynamatic Eddy-Current Equipment do not require a special power source or motor-generator sets.

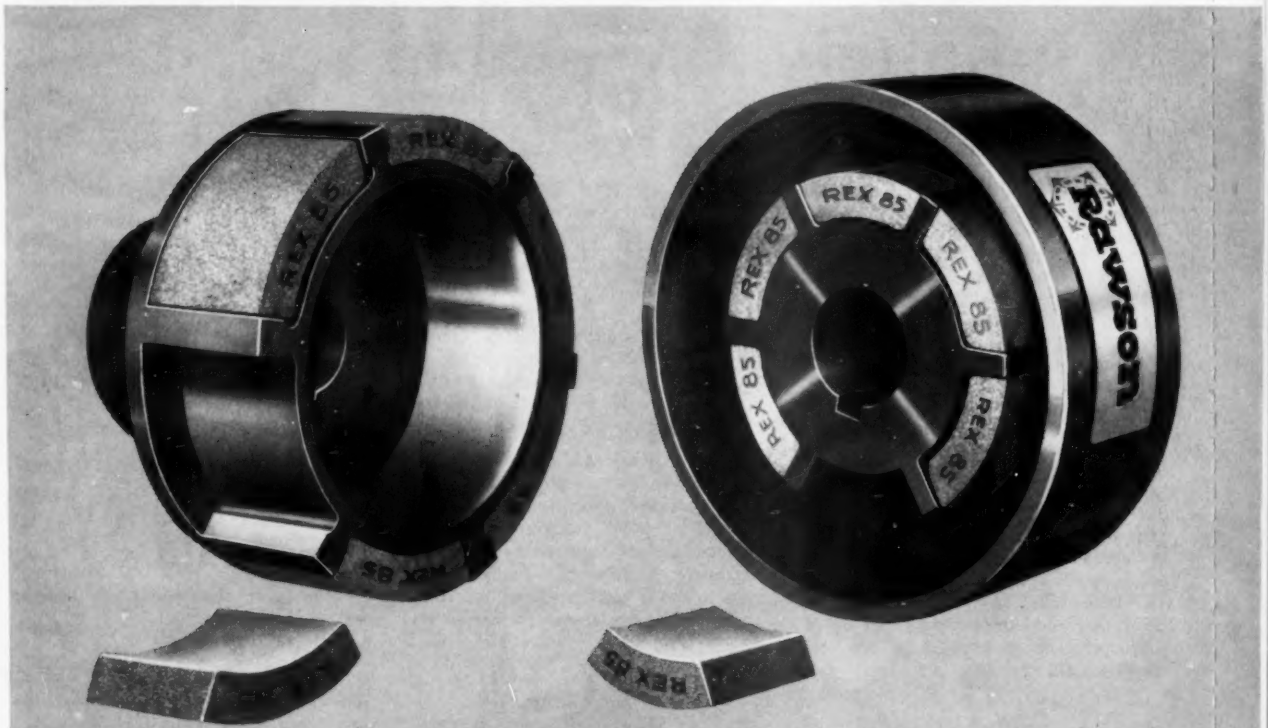
Send for your copy of Bulletin D-582 which gives detailed information on Dynamatic Eddy-Current Equipment.

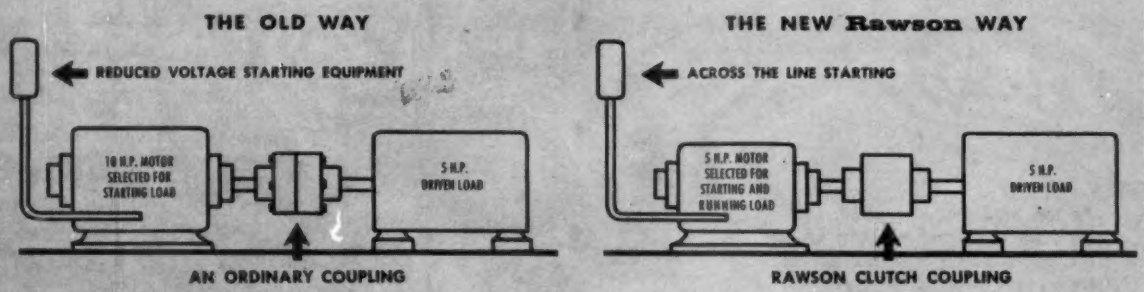
EATON®

DYNAMATIC DIVISION
MANUFACTURING COMPANY
3307 FOURTEENTH AVENUE • KENOSHA, WISCONSIN

Circle No. 60 on Reader Service Card

NOW! You Can Use Smaller Motors Improve Motor Performance




THE OLD WAY
REDUCED VOLTAGE STARTING EQUIPMENT
10 H.P. MOTOR SELECTED FOR STARTING LOAD
5 H.P. DRIVEN LOAD
AN ORDINARY COUPLING
THE NEW Rawson WAY
ACROSS THE LINE STARTING
5 H.P. MOTOR SELECTED FOR STARTING AND RUNNING LOAD
5 H.P. DRIVEN LOAD
RAWSON CLUTCH COUPLING

Check These Additional Features of

- Exclusive all-metal shoes permit higher operating temperatures, assure longer life.
- For power applications up to 2,000 horsepower, drive in either direction.
- Fluid-smooth starting without the power loss of fluid types at full load R.P.M.
- Protects the most delicate equipment by eliminating starting shock.
- No dangerous prolonged surge current when high-inertia equipment is started.
- All-metal shoes never need adjusting, entirely mechanical operation assures longer life.

. . . Lower Starting Equipment Costs . . .

. . . Secure Automatic Overload Protection

With Rawson

Centrifugal Clutches

The Rawson is an all-metal centrifugal clutch that drives in either direction and provides: *no-load* starts for motors—cushioned starting of equipment at predetermined R.P.M.—automatic overload protection—slip-free power at normal operating speeds—rugged design for applications up to 2,000 horsepower.

Results: "no-load" starting decreases acceleration time and starting current—across-the-line starting can be used instead of costly reduced voltage equipment—based on lower starting load, smaller motors can often be employed—cushioned starting of high inertia loads frequently permits using NEMA B or standard squirrel-cage motors instead of expensive special high-torque motors—delicate equipment is protected by eliminating starting shock—jamming or overloading of driven equipment will cause the clutch to slip, providing protection for motor.

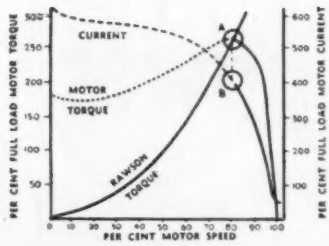
Rawson clutches function as direct-drive clutch-couplings (in-line, shaft-to-shaft connection) or as indirect-drive clutches through V-belts, chains or gearing. They can be furnished with delayed engagement for standby or dual drive installations.

Rawson clutches are simple in design, they never require adjustment, and are entirely mechanical in operation for trouble-free performance. For higher efficiency, lower costs, reduced maintenance and full protection for even the most delicate equipment, specify Rawson centrifugal clutches and clutch-couplings.

Ask your Rawson distributor or write directly to us for your free copy of Rawson Catalog No. 141.

FORMSPRAG COMPANY
23587 Hoover Road, Dept. 109
Warren (Detroit), Michigan

FORMSPRAG COMPANY



Typical torque and current characteristics of a standard NEMA B motor. Because Rawson clutch does not fully engage until after peak torque speed "A" is reached, motor acceleration time is much faster, peak current period is greatly decreased and motor operates more efficiently "B". Thus, smaller motors and across-the-line starting can be used.

Rawson Clutches

- **No-load starting reduces motor acceleration time to a fraction of a second.**
- **Full power at normal operating R.P.M.—No Slip, No Power Loss, No Heat.**
- **Rugged design and all-metal construction keep maintenance requirements to a minimum.**

THERE IS A FORMSPRAG OVER-RUNNING CLUTCH FOR EVERY OVER-RUNNING, INDEXING & BACKSTOPPING APPLICATION

Modern Formsprag over-running clutches are universally used by automotive, aircraft and other industries. They provide greatest torque for size and weight, higher precision and no measurable backlash. Torque capacities range from 50 lbs. in. to 136,500 lbs. ft. Standard bore sizes from ¼" to 12". Our engineering department will design special Formsprag clutches for your unusual applications. Write for your copy of Formsprag catalog.

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U. S. ROYAL V-BELTS from the Power Unlimited complete belt line

Exclusive new process gives

balanced driving power

Now you can give your equipment the kind of driving power that comes only from V-belts that are as close-to-perfect as the world's most advanced manufacturing methods can make them. Specially developed equipment automatically controls thickness, weight, density, length, and tension members so precisely that each U. S. Royal gives you *balanced* driving power that pays off in every aspect of a belt's performance.

Smoother running. Variations inherent in other belts lead to vibration, intermittent slippage, increased bearing wear, excessive heat build-up, and early belt failure. Because of the "balanced driving power" resulting from exclusive manufacturing processes, U. S. Royals are the sweetest running belts in the business.

Unequaled length stability. Test after test has demonstrated that each U. S. Royal V-Belt with balanced driving power is a perfect working match for the others in its set. And every U. S. Royal V-Belt on a multiple drive will *continue* to pull its share of the load long after other "matched" belts have begun to assert their individuality.

No weak spots. Because there are no "weak links," you get longer lasting driving power and greater freedom from maintenance than ever before. Take advantage of the balanced driving power only U. S. Royal V-Belts offer. Your "U. S." Power Transmission Distributor has full stocks to service you promptly.

Mechanical Goods Division

United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

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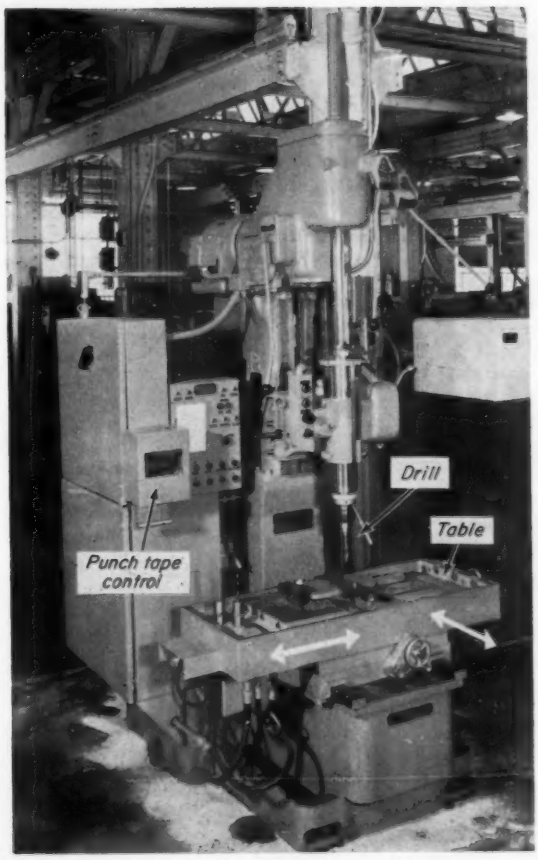
DESIGN
IDEAS
FROM THE FIELD

Servo motor controls hydraulic positioning



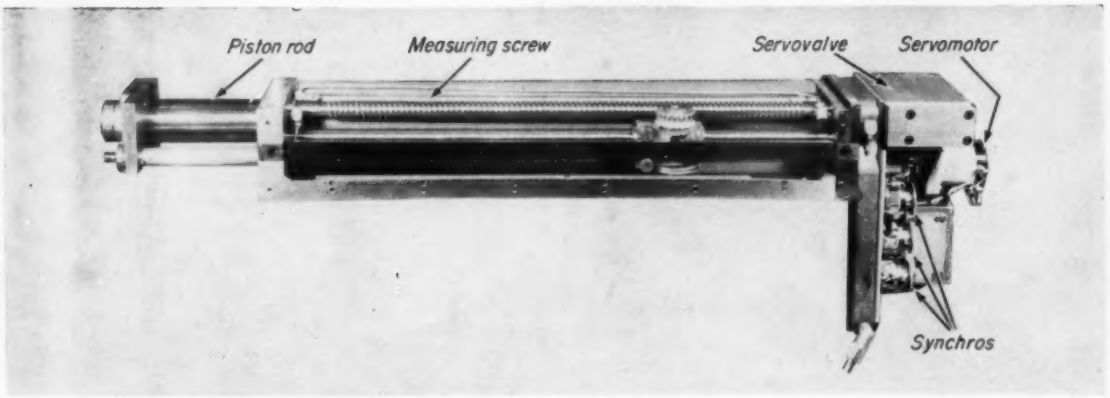
TWO POSITIONING UNITS move table of drilling machine in two directions for repetitive drilling. Punched tape commands move to next position after each drilling.

SERVO MOTOR drives a lead screw that controls a hydraulic system which in turn positions a machine tool table within ± 0.001 in. true. The axial motion of the lead screw as it rotates moves the servo valve spool to direct hydraulic oil under pressure to the large side of the hydraulic piston. This moves the machine tool table.

Difference between desired and actual position is determined by four synchros. A punched tape provides position signals to the synchros by electrically positioning the stator field. Stator field may be positioned in any one of 10 discrete positions. Electrical output from the synchros is proportional to the relative displacement of rotor and stator fields. Synchro outputs define the distance the table should move.

Synchro output is electronically amplified to drive the servo motor. Automatic switching in the amplifier selects input from the synchros successively from coarse to fine as the output of the synchro for the larger increment goes to zero. All synchros are geared to the servo motor in 10:1 ratio so that rotation of the servo motor drives the rotors to a null or no output position.

Rotation of the servo motor also rotates the measuring screw and displaces it to left or right depending



POSITIONING UNIT incorporates hydraulic cylinder, servo valve, position synchros, servo-motor.

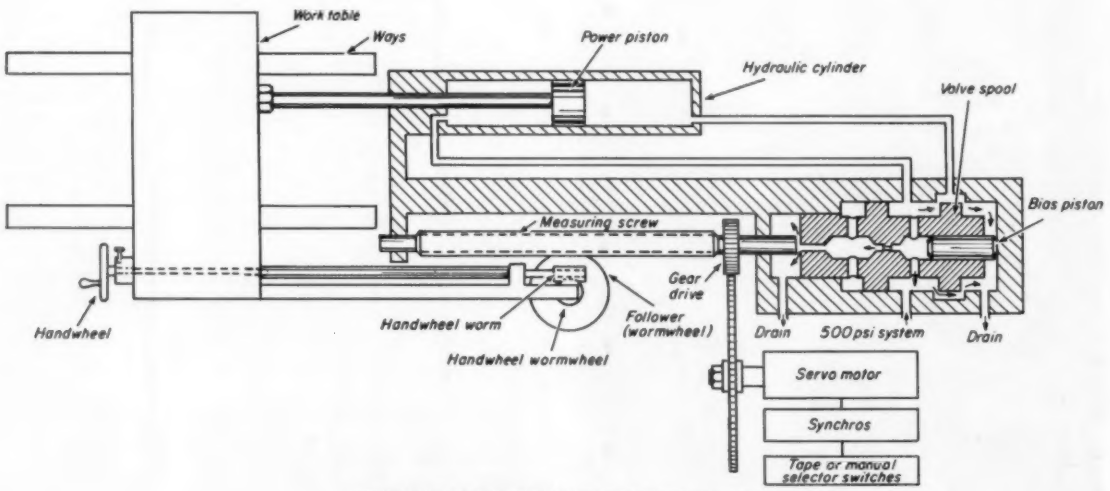
SERVO MOTOR *continued*

on the direction of rotation. This is caused by thrust forces from a worm wheel in mesh with the screw. Axial motion of the screw shifts the servo valve to actuate the hydraulic piston.

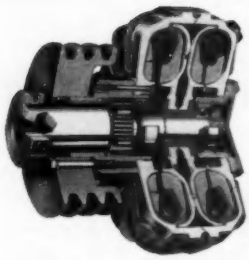
There is no actual contact between the end of the screw and the valve spool. The end of the screw controls the rate of oil bleed from one end of the pressure-shifted valve spool to cause the spool to move in one direction or the other depending upon the pressure differential created. This results in extremely fast table action. Also, there is no end wear or loading of the measuring screw from the valve spool.

As long as the servo motor drives the screw, it is axially displaced to shift the valve spool and cause the piston to drive the table. When the servo motor has driven all four synchros to the null position, the servo motor stops, the valve spool is centered and the table stops.

Two of these units are used for both X and Y displacement of tables on drilling, punching, and boring machines. However, it can also be applied to any machine with similar requirements, such as multiple spot welding or stamping. *Jones & Lamson Machine Co., Machine Tool Div.*, Springfield, Vt., make the positioning unit as well as machines on which it is used. ▲▲▲



SCHEMATIC DIAGRAM of positioning unit.



Convert to FLUID drive in only 5 MINUTES!

Fluid drive in a package . . . complete, ready-to-install . . . slips right over the motor shaft, easily in a matter of minutes. That's the Twin Disc HYDRO-SHEAVE® Drive—compiling new records for high production and low equipment maintenance.

Here's what the HYDRO-SHEAVE does

1. Reduces starting current demands . . . provides smooth, fast motor acceleration.
2. Protects against motor overloads, stalling and burn-outs.
3. Transmits full motor torque at all speeds.
4. Cushions out destructive vibrations and shocks, protecting both driving and driven equipment.
5. Permits motor selection based on running load rather than starting load.

Twin Disc HYDRO-SHEAVE Drives are available for ¾ to 50-hp capacities. We also furnish HYDRO-WYND® Drives, Models 8.4 and 12.2, for winding and tensioning.

Check with us for full details on these profitable fluid drives. See how easily they will solve your power transmission problems. Request Bulletins 144-D and 145-C.

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES

TWIN DISC
Friction Clutches and Fluid Drives

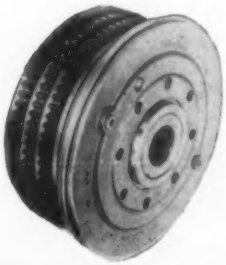
Immediate delivery on the drives you want

Twin Disc Fluid Couplings

Easily-installed units with many input-output combinations to match any hook-up. Sizes from 7.4S to 27 for ¾ to 850 hp engines and motors. Smaller couplings are cast aluminum; larger sizes are stamped steel. Both combine maximum capacity with minimum space and weight. Wear and breakdown are virtually eliminated.

Twin Disc CL Clutches

Rugged mechanical clutches in sizes from 5" to 11⅜" with 14 to 112 hp capacities. Choice of one, two or three gear-tooth drive plates designed to mate with driving ring or spider. No tools needed for adjustment — adjusting pin is pulled manually and clutch rotates clockwise on threads. Throwout yoke and hand lever furnished.



Twin Disc PO Air Clutches

Similar to CL Clutches except for air-actuation feature. Designed for remote control without complex linkages where compressed air source of 60 to 130 psi is available. Self-compensating for wear — never need adjusting. Cartridge type diaphragm positively prevents air leakage. Sizes from 8" to 36" with one, two or three drive plates.

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division), Rockford, Illinois

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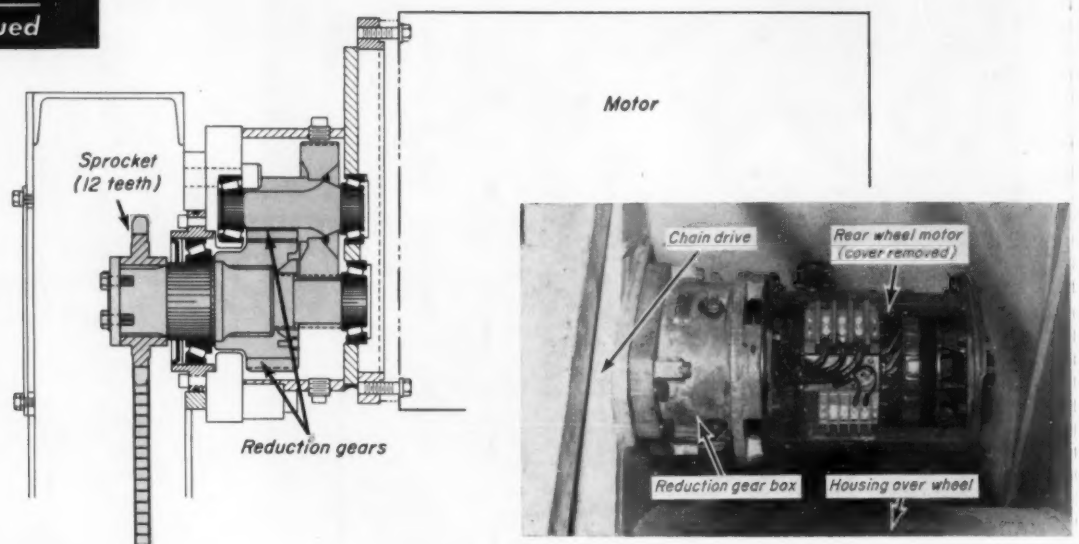
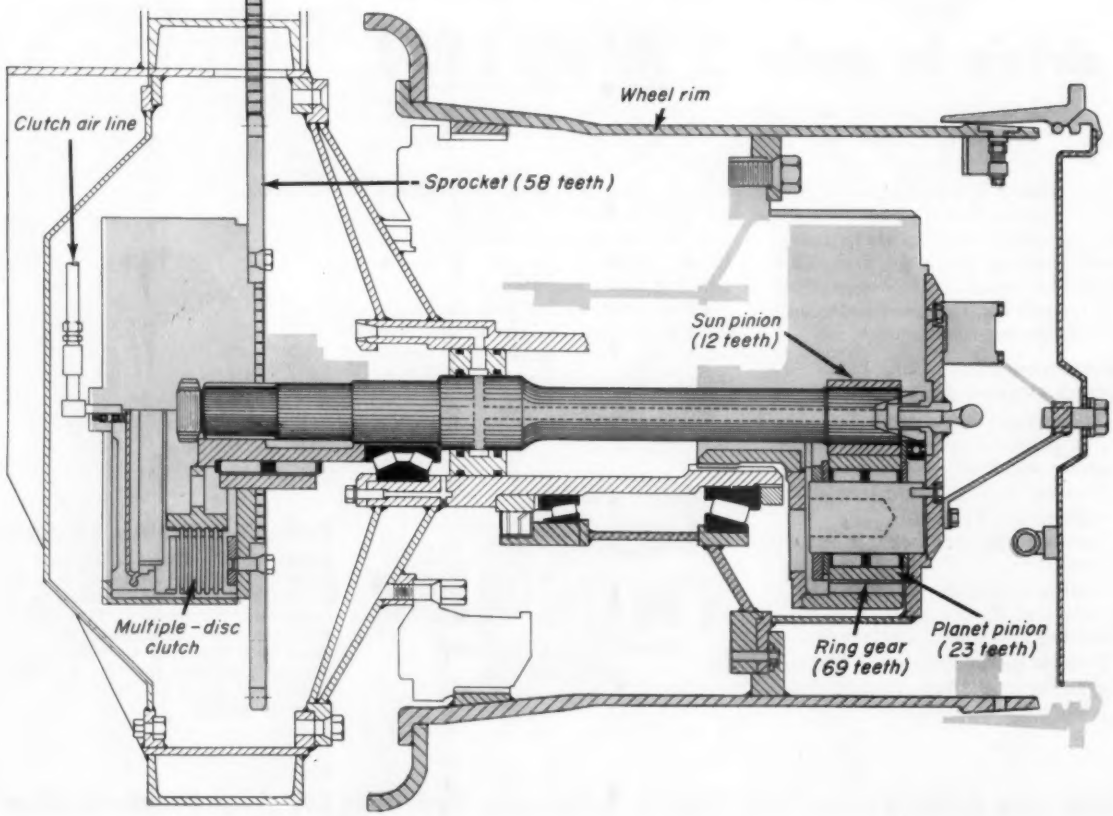
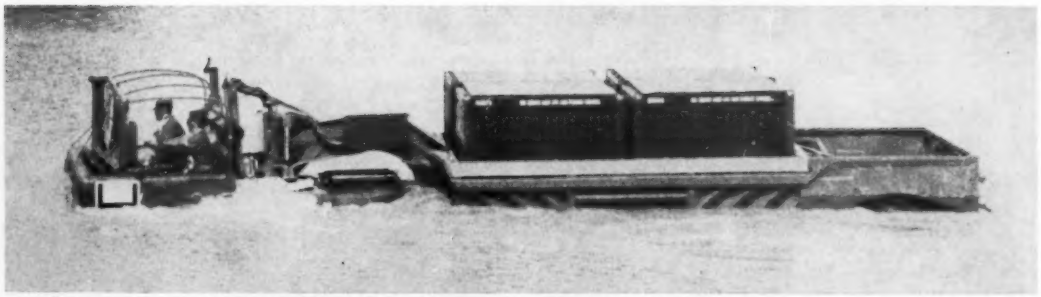


Electrical drives on





GOER IN THE SWIM during evaluation tests at Fort Knox Ky.

rear wheels increase traction

ELECTRICAL DRIVES to the rear wheels of a new off-the-road transport vehicle increase mobility over rough and muddy ground.

The vehicle articulates. The engine is at the front of the two-wheeled tractor. Transmission of power to the trailer rear wheels would be extremely difficult except electrically.

Each rear wheel has its own motor. The motors are ac, squirrel cage. Synchronous speed of the motors at maximum engine rpm is 5750 rpm. A ten-pole generator supplies about 200 cps ac to the motors at maximum engine rpm. Speed control is by the engine throttle system which increases or decreases speed of the generator and thus the frequency.

Spur gears in a gear case integral with the motor provide speed reduction of 15.75:1. An additional reduction step of about 4.8:1 is added by a chain drive consisting of a 12 tooth sprocket on the motor shaft and a 58 tooth sprocket on the shaft which drives final planetary reduction gearing within the wheel. The planetary gears have 6.75:1 reduction ratio to give total reduction from motor to wheel of 512:1.

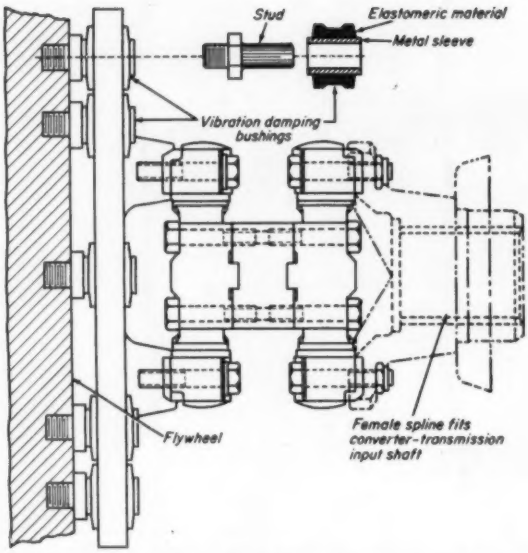
An interesting feature of this design is that the 58 tooth sprocket is mounted eccentric with the bore of the wheel mounting. The small eccentricity—3/8 in. —lets the whole wheel mount be rotated to take up small amounts of play in the chain drive. Play, greater than is allowed for by the eccentricity, may be removed by taking a link out of the chain.

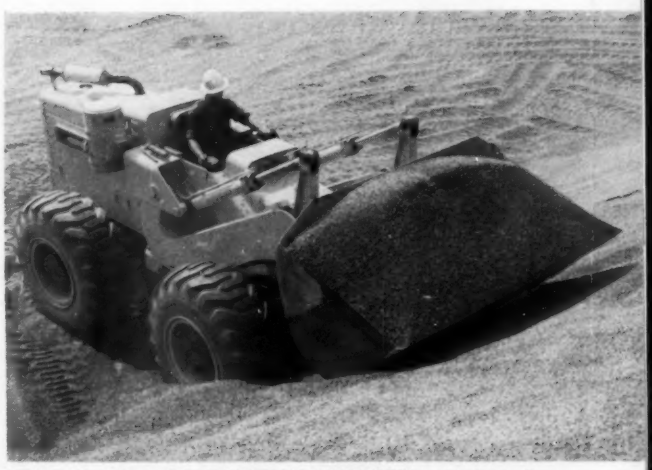
Air-operated multiple-disc clutches are used between the final sprocket and the planetary drive shaft to let the chain drive and motor be disengaged when not needed for additional pulling power.

Addition of the auxiliary electric drive to this vehicle was simplified by the fact that a generator was already a part of the design to provide power for the motors which steer the vehicle by pivoting the entire tractor section.

Two models of this vehicle, one a 15-ton cargo carrier, the other a 5000-gal tanker have been built for the Army by *LeTourneau-Westinghouse Co.*, Peoria, Ill. In evaluation tests to-date, they have shown themselves to be accomplished swimmers in addition to their ability to go where conventional Army trucks and transporters have bogged down. Propulsion when in the water is provided solely by the spinning tires. Because of these accomplishments, the vehicle has been dubbed the Goer. ▲▲▲

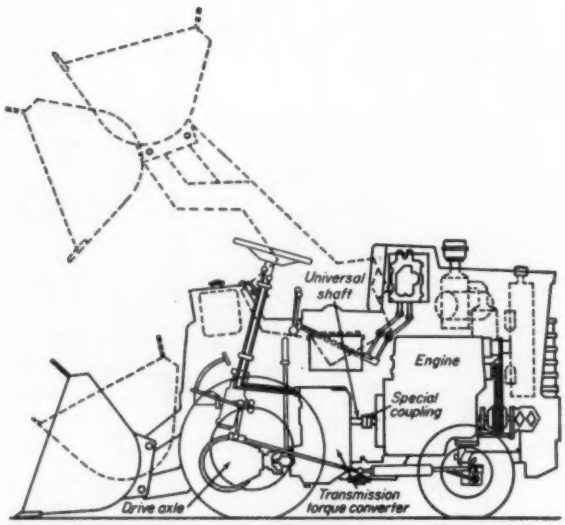
AUXILIARY DRIVE MOTOR is installed above wheel housing at rear of trailer. Boxed-in, it is protected from water when vehicle swims.





SPECIAL TORSION DAMPING COUPLING eliminated breakage of the universal shaft.

Rubber bushings stop universal shaft breakage



UNVERSAL SHAFT BREAKAGE was caused by midship mounting of converter-transmission.

TORSIONAL VIBRATION with peaks more than four times rated peak output torque continually broke a short universal shaft. Solution to the problem was to drive the universal shaft through a special plate in which 8 small bonded rubber vibration absorbing bushings were fitted. The shaft connects the engine to the midship-mounted torque converter transmission unit.

It was the midship mounting, necessitated by physical layout of the tractor-shovel, that created the problem. Ordinarily, the torque converter is mounted directly to the clutch housing of the engine and damps the torsional peaks so they are not transmitted to the remainder of the drive train. Actual measurement determined that 850 ft-lb torque peaks from the 200 ft-lb output engine were breaking the shaft.

The engine drives the plate through studs which screw into the flywheel. These studs simply slip into the center of the vibration absorbing bushings. The plate is fastened to the front universal of the universal shaft by 4 cap-screws which screw into bosses on the plate in which the bushings are fitted.

This special coupling is used on the model H-90 4-wheel drive Payloader, made by *The Frank G. Hough Co.*, Libertyville, Ill. ▲▲▲

Fawick Airflex Clutches on ship unloader pay off quickly thru . . .

power transmission by remote control

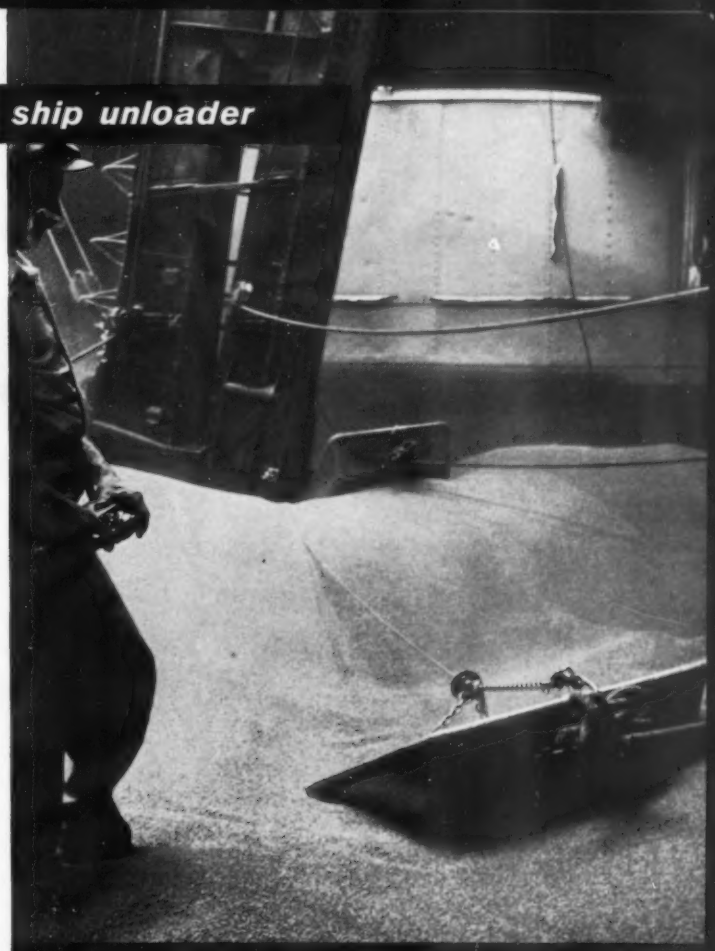
Adaptability to remote control is an inherent advantage of FAWICK Airflex Clutches that pays off fast in terms of reduced cost.

A typical example is the push-button ship unloading system at Maple Leaf Milling Company, Ltd., Port Colborne, Ontario, Canada. Here, one man operates the small portable control panel to actuate four FAWICK Airflex Clutches which regulate forward and reverse movements of the drag line scoops. Since modernizing with FAWICK three years ago, the company can point to important reductions in:

- **manpower requirements—down 30%**
- **unloading time—down 20%**
- **power requirements—down 60%**
- **clutch maintenance—none in three seasons**

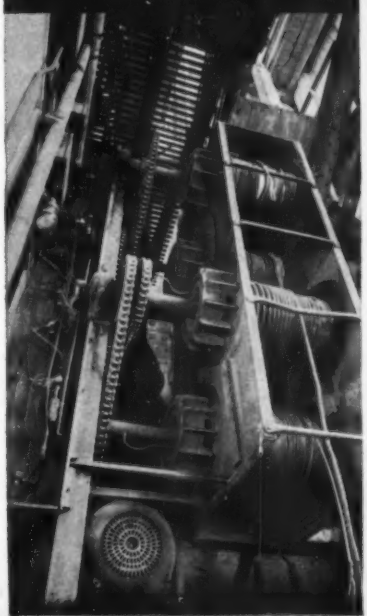
Through these direct savings the FAWICK units helped pay for the installation in only *one* year!

Performance of this type demonstrates FAWICK's adaptability to many and varied power transmission applications . . . and ability to produce benefits that you can count in dollars. Call your nearest FAWICK representative or contact the Home Office for expert assistance in selecting the best clutch for your application.



Deep down in the ship's hold, marine power shovel operator is equipped with push-button controls for Fawick Airflex Clutches mounted high above in grain elevator. Instant response of the Fawick units assures precision accuracy in directing movement of multiple scoops which carry grain to intake of lift leg.

Four Fawick Type E Air-Ring Clutches are mounted at "lead line" and "pull-back" drums to control forward and reverse movement of scoops (see above). Designed especially for rugged duty of this type, the clutches have required no maintenance since installation.



Ship unloading system at Maple Leaf Milling Company. Remotely controlled Fawick Airflex Clutches, installed in elevator at right, are directly responsible for $24,000 annual savings in unloading costs.

FAWICK AIRFLEX DIVISION
FAWICK CORPORATION
9919 CLINTON ROAD • CLEVELAND 11, OHIO
Fawick Canada, Ltd., 60 Front St., West, Toronto, Ont., Canada

FAWICK AIRFLEX

INDUSTRIAL CLUTCHES AND BRAKES

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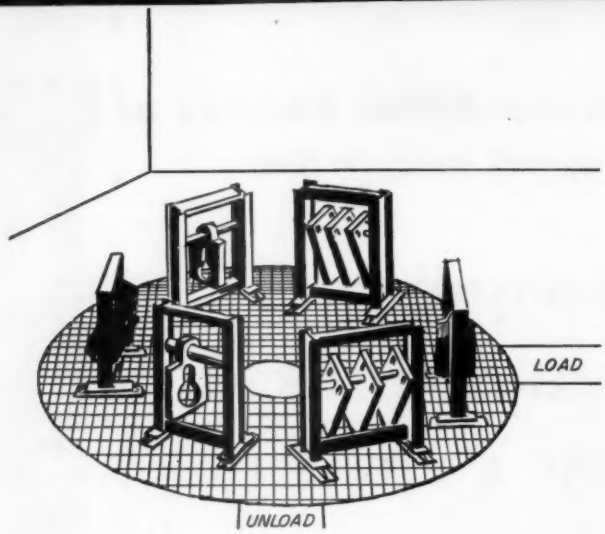


Fluid coupling lets 3 hp motor drive 23 tons

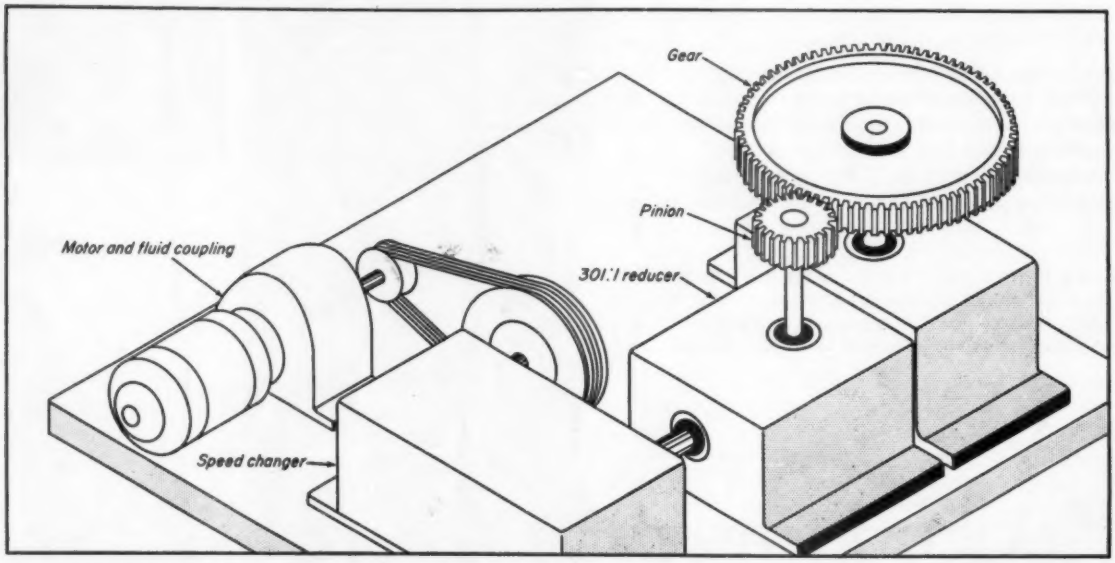
LOAD CUSHIONING by a fluid drive lets a 23-ton rotary test stand be driven by a 3-hp, 1200 rpm motor. Rotation rate is not high since there is sufficient reduction in the system to let the table revolve at speeds ranging from 3.66 min/rev to 5.66 min/rev.

However, inertia of the table and its load is so high that a motor of this size just couldn't handle it without a device with the characteristics of a fluid coupling.

The drive system, mounted in a pit below floor level, is made up of: the motor, driving through the fluid coupling to; a variable-ratio speed reducer which gives output speeds of 256 to 768 rpm; a triple-reduction speed reducer with 301.1:1 reduction; then a pinion and bull gear for the final table drive. Pinion pitch diameter is 12.8 in.; gear pitch diameter is 76.8 in.

The table is made up of metal grating and plate. Drive is at the center. Rollers around the periphery of the table guide and support it. Boiler sections for heating systems and similar applications are tested with water under pressure on the table. They are loaded, clamped, tested, and unloaded during approximately one revolution.

Design of this system is by the plant engineering department of the *Bond Plant, American-Standard, Plumbing and Heating Div.*, Buffalo, N. Y.



23-TON TABLE, about 30 ft in diameter is driven by a 3-hp motor. It serves as a revolving test stand.

Morse engineers look to space from a down-to-earth viewpoint!

Sky is never the limit with the research and development staff working with the broad facilities at Morse.

Morse has grown up with the automotive industry. Its specialists have worked with designers and engineers in developing and perfecting the products of their imagination.

For more than 60 years, Morse has specialized in the science of kinematics. Perhaps its best known products are basic chain drives, gear reducers, couplings, and clutches in more major fields than you could count on the fingers of both hands.

Morse engineers, supported by Borg-Warner's ultra-modern research laboratory, can now offer a better way of giving your ideas a boost, and provide down-to-earth solutions to your problems in the race for space. Consult: Morse Chain Company, Dept. 27-30, a Borg-Warner Industry, Ithaca, N.Y. In Canada: Morse Chain of Canada, Ltd., Simcoe, Ontario.

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VARIABLE
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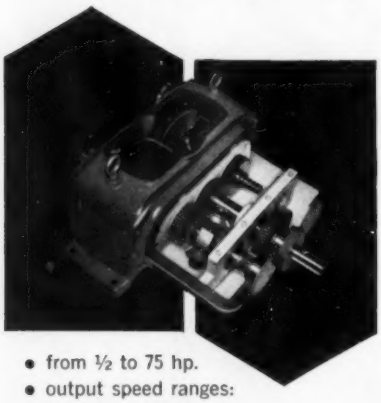
DRIVES
electrical and mechanical



- from ½ to 75 hp.
- output speed ranges: 0-100 to 0-7000 rpm
- smoothly adjustable through zero speed
- draw accuracies of .01%
- full torque at zero speed

These are just some of the outstanding characteristics of Specon variable speed drives. Rugged, reliable and requiring minimum maintenance, they permit infinitely fine adjustment of output speed with accuracies approaching fixed gearing. Specon drives also feature shockless starts and acceleration, full reversing, and provide output speeds up to 7000 rpm while maintaining zero speed features.

Send for FREE data booklet on Specon variable speed drives.

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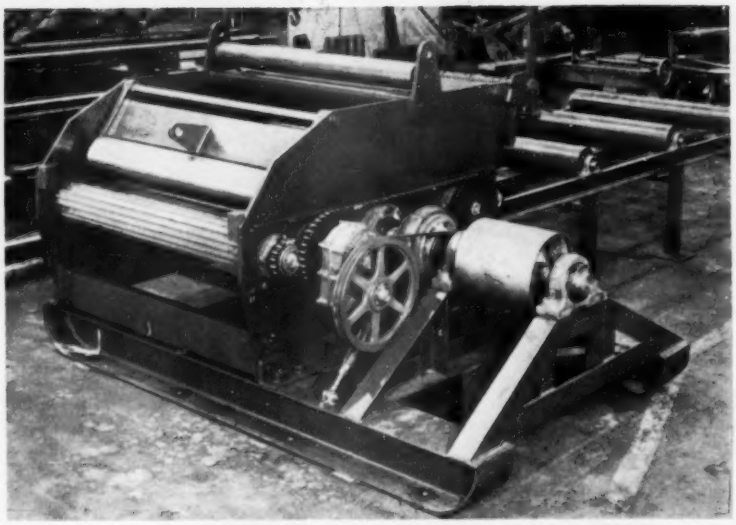
A DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION
INDUSTRIAL PRODUCTS BRANCH
#42, Route 109, West Babylon, N. Y.

Circle No. 63 on Reader Service Card



COMPACT DRIVE, all on one side of machine, is due to use of a shaft-mounted reducer.

Shaft-mounted reducer permits easy access

COMPACTNESS in the drive system of a lumber edger is gained by using a shaft-mounted reducer. The basic drive problem here is to drive the saw arbor in one direction at about 2000 rpm, and four feed rolls in the reverse direction at about 130 rpm. One side of the machine must be left unobstructed to provide easy access to the arbor for changing saws.

The machine is supplied with either a flat pulley or V-belt sheave so the purchaser may use his own motor and belt drive. The arbor shaft is driven through a flexible coupling at 1900 to 2000 rpm. A dual V-belt sheave on the extension of the drive pulley, or sheave, drives the shaft-mounted reducer. Drive sheave is 5.4 PD; driven sheave on the reducer is 15.4 PD.

Shaft-mounted reducer is mounted on the shaft extension of one of the feed rolls. The torque arm runs down to the machine base and has a turnbuckle adjustment for tensioning the V-belts. By shortening the torque arm with the turnbuckle, the reducer rotates about the output member, and since the input shaft and output member are not coaxial, this increases the belt center distance. Reducer ratio is 5.32.1 and output rotation is the reverse of input rotation. This causes all feed rolls to rotate in the direction opposite saw rotation.

A dual sprocket mounted on the driven feed roll shaft connects by roller chain to an adjacent feed roll and to one of a similar pair of rolls at the other end of the machine. This roll in turn drives the one adjacent to it by a short chain.

Another advantage of this system is the ease with which the sheave on the reducer may be changed to give variations in feed roll speed.

Purpose of an edger is to rip wide boards into useful sizes and at the same time remove the bark from the edges, when present. This machine was designed and is built by the *Mainland Foundry Co., Ltd.*, Vancouver, B. C., Canada. ▲▲▲

IN PILLOW BLOCKS, FLANGE and FLANGETTE UNITS

MRC MARLIN-ROCKWELL RELIABILITY COUNTS

Pillow Blocks & Flange Units with MRC Labri-Seal® Ball Bearings

MRC Pillow Blocks

MRC Flange Units

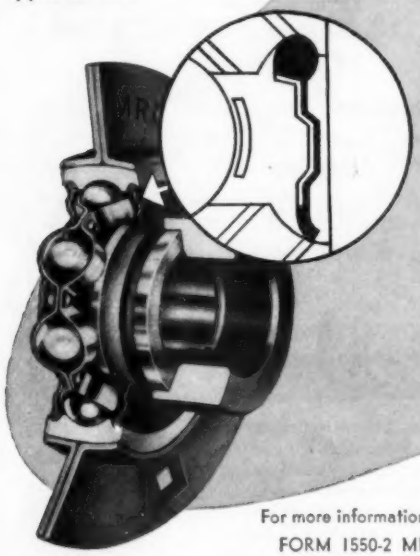
MRC Pillow Blocks and Flange Units combine smooth contour and compact design with rugged strength. They are equipped with MRC Labri-Seal Ball Bearings.

The Labri-Seals combine the advantages of a rotating flinger, labyrinth seal and positive contact synthetic rubber seal.

The bearings are lubricated with a high quality, long life grease at assembly — eliminating necessity of further lubrication — resulting in longer life and savings in maintenance cost.

MRC LABRI-SEAL Ball Bearings *keep out dirt and moisture and retain the bearing lubricant.*

Their efficiency is proven in thousands of successful applications.



MRC Flangette Units

Flangettes with MRC Synthe-Seal® Ball Bearings

The MRC Flangette design provides a high quality — easily installed unit with a versatile mounting arrangement for agricultural and industrial applications.

MRC Flangette Units are complete with MRC Synthe-Seal Ball Bearings with locking collar.

MRC Synthe-Seal Ball Bearings have a long history of successful operation in thousands of applications including extreme conditions of dirt and moisture and where leakage of lubricant might damage products being processed.

For more information write or phone for:

FORM 1550-2 MRC BALL BEARING PILLOW BLOCKS AND FLANGE UNITS

FORM 1547-2 MRC POWER TRANSMISSION BALL BEARINGS
FORM 1528-13 MRC SYNTHE-SEAL® BALL BEARINGS
ENGINEERING NO. 7-17 FLANGETTES

Marlin-Rockwell Corporation
Jamestown, N. Y.

MRC BALL AND ROLLER *bearings*

Circle No. 31 on Reader Service Card

NEW PRODUCTS

Spray-on chain lubricant

Packaged in a 16-oz. push-button aerosol container, this lubricant was formulated for open chains, and is

said to combine the features of a penetrant, lubricant, and rust-preventive to lengthen chain life. You can get a free trial 16-oz. can of this lubricant by circling the number below.

Whitmore Mfg. Co., Cleveland, Ohio.

Circle No. 200 on Reader Service Card

Multi-speed transmission

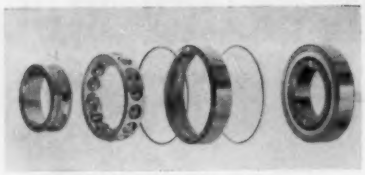
A compact, economy multi-speed transmission is available from factory stock. Called the Econo-Drive, its dimensions are 5-21/32 x 8¼ x 10½ in.; weight, 36 lb; 3-speed 3 hp; speed ratios, 1:1.53, 1:1, 2:1; output speeds, with 1800 rpm input speeds, 3754, 1800, 900.

Turner Uni-Drive Co., Kansas City, Mo.

Circle No. 201 on Reader Service Card

Heavy-duty bearings

Load capacities up to 55% greater than equivalent Conrad type bearings are claimed for these high-precision radial ball bearings. Performance advantages are said to result from the single-fracture design which utilizes maximum ball complements. Full-depth, symmetrical raceways with no loading slots permit bearings to carry thrust loads



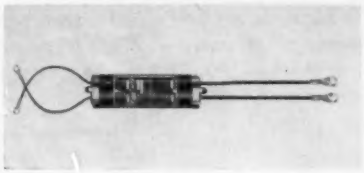
from either direction. The one-piece, outer land-riding bronze retainer is said to be strong, to improve internal lubrication, and permit high operating speeds.

Split Ballbearing Corp., div. of Miniature Precision Bearings Inc., Lebanon, N. H.

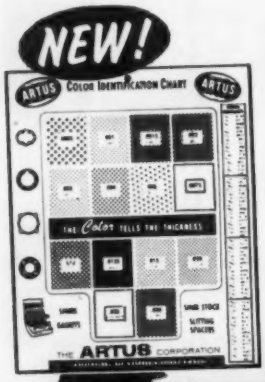
Circle No. 202 on Reader Service Card

Hermetically sealed switch

Power contactor, rated to 20 amps, can be used where repeated contact is required. Contacts are between tungsten and mercury, hermetically sealed in gas to prevent oxidation of points. It operates with low voltage



NEW!



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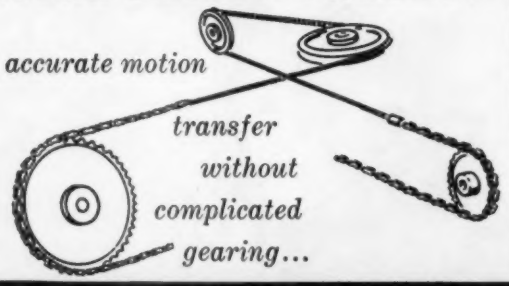

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Provide precise, positive motion transfer through several planes simultaneously with no cable slippage...no complicated gearing. Unlimited center-to-center selection for miniature and sub-miniature assemblies in servo systems, gyro systems, special cameras, electronic equipment, and small precision instruments. Less weight, cost, maintenance —wider tolerances. Designed to operate around minimum 7-tooth sprocket with root diameter of .250 inches. Chain pitch .1475 inches; Weight .45 oz. per lineal ft. Material: stainless steel, or other materials, including non-magnetic beryllium copper.

NEW CATALOG

Contains useful application data, specifications, tables on chain pitch and sprocket sizes, suggestions for calculating center-to-center distance. *Write for yours today.*

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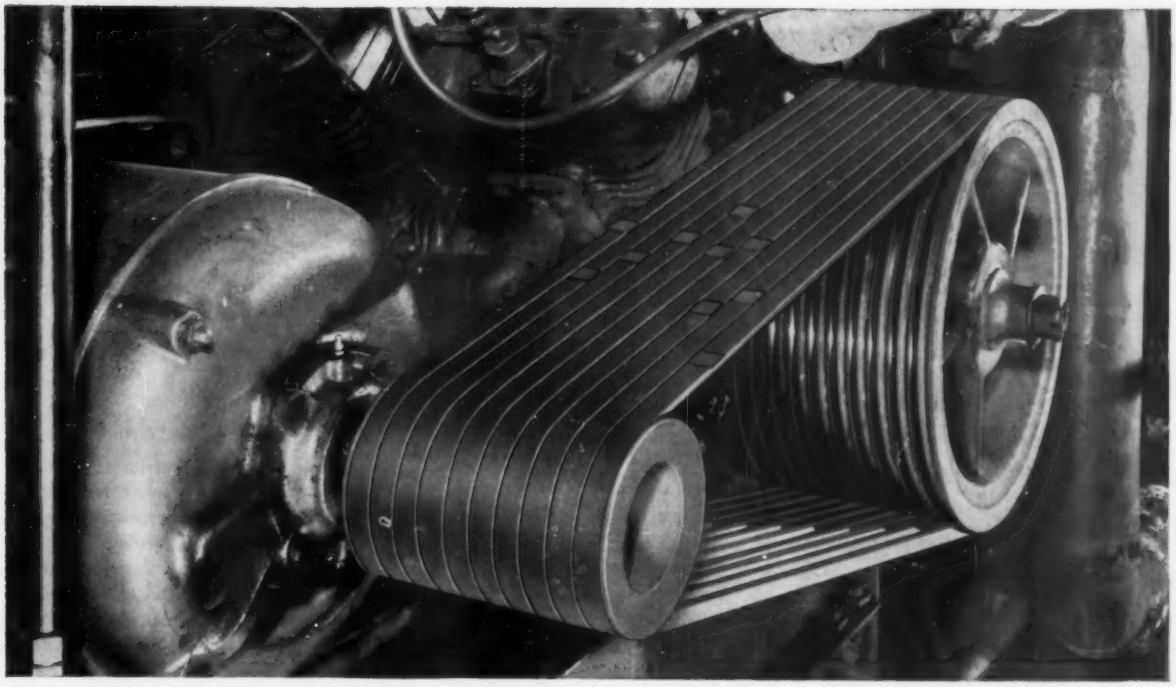


No Matching Problems with the New Dayton

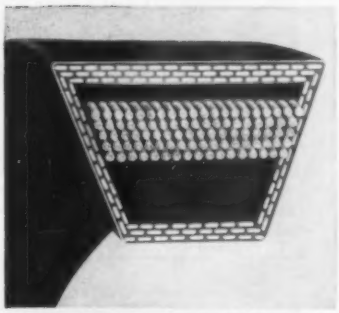
BLUE RIBBON Thorobred® V-Belt

Belt matching is no longer a problem, thanks to the exceptional length stability of these new Dayton Blue Ribbon Thorobreds . . . which can now be ordered in perfectly matched sets. Elasticity is *controlled* by new super-strength cords to allow belt to absorb machine-killing shock loads and vibration.

Thus each belt pulls an equal share of the load, assuring you maximum drive performance, maximum belt life, and important cost savings through reduced machine downtime.

And with horsepower ratings now 40% higher than ever before, the Dayton Blue Ribbon Thorobred line also offers a much greater range of horsepower capacities . . . without the expense of new-type sheaves.

The Blue Ribbon V-Belt is not just a redesigned belt, but a totally new approach to V-Belt construction. Everything is new: new rubber compounds, new length controlled synthetic fibres, and a new double-wrapped "High Twist" cover.



70% to 120% increase in H.P. ratings for Blue Ribbon Super Thorobreds®
For the really tough drives Dayton Blue Ribbon Super Thorobreds offer a greatly increased range of load capacities. In addition, they are oil and heat resistant and static-dissipating.

Find out how you can improve performance and cut costs with the Dayton Blue Ribbon Thorobred V-Belt line. Write today to:

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INDUSTRIAL DEPT.

Dayton Industrial Products Co.

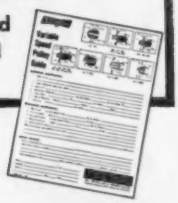
2001 Janice Avenue Melrose Park, Illinois *A Division of The Dayton Rubber Co.*

Circle No. 13 on Reader Service Card

Take ALL the Problems Out of Your Variable Speed Requirements

Put Lovejoy's exclusive individualized service to work for you...a complete line of variable speed pulleys and transmissions—plus personalized engineering guidance to assure full satisfaction.

- Speed ratios: up to 10 to 1
- Horsepowers: fractional to 15
- Constant belt alignment
- Instant speed changes while equipment is running
- Easily installed on new or old equipment.



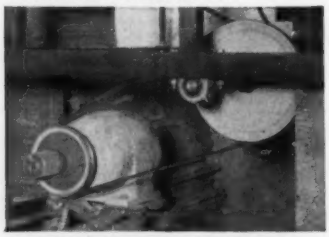
Here's how it works...

a simple and convenient two-step plan:

❶ Lovejoy sends you full information on the types of variable speed pulleys and transmissions available . . . along with a guide sheet to help you supply us with pertinent information on the type you need and the service you require.

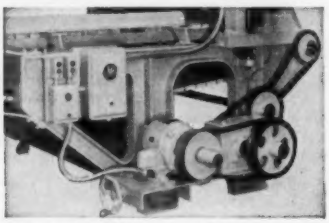
❷ Depending on your requirements, Lovejoy rushes recommendations, blue prints, suggested solutions to problems . . . or, if you desire, will send a representative to give you first-hand assistance. For standard or relatively simple applications, cost quotations can be furnished immediately.

TYPICAL EXAMPLES:

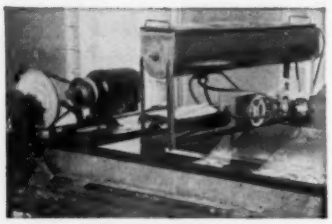


Type 160 Pulley and No. 200 Tilting Motor Base proved the right combination for a mailing machine.

Type 135 Pulley meets all requirements on a vibrating machine.



Proper drive for a slat bed rip saw is provided by a Type 302 Pulley.



This Lovejoy "double" solved a grading machine problem—Type 145 Pulley and No. 2 Select-O-Speed.

Save time and expense. Get your Variable Speed Pulley Guide by requesting Form 118F today.

LOVEJOY FLEXIBLE COUPLING CO.

4852 WEST LAKE STREET • CHICAGO 44, ILLINOIS

Circle No. 29 on Reader Service Card

on primary side, and is available in a complete range of voltages. It also can be used under a voltage control relay where a reduction in voltage would be dangerous or as an overload voltage control relay to protect equipment from unusually high surges of voltage.

Energy Kontrols, Inc., Geneva, Ill.

Circle No. 203 on Reader Service Card

Heavy-load roller chain

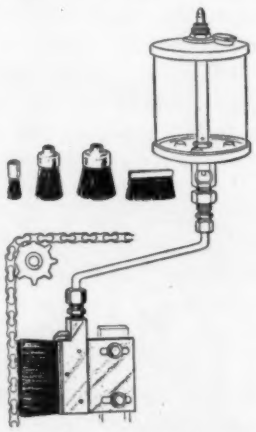
Roller chain has been developed to handle heavy loads where operating conditions are extremely difficult. This offset side bar roller chain is built to provide the sure action of ASA roller chain, plus the added clearances to resist faulty articulation caused by rust or accumulation of foreign materials.

Atlas Chain & Mfg. Co., West Pittston, Pa.

Circle No. 204 on Reader Service Card

Vertical chain oiler

This chain oiling system for lubricating vertical chain drives consists of a brush applicator, oil dispenser, and copper tubing connecting the two components. Oil is fed to the



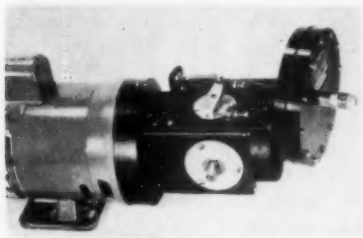
top of the brush, seeps through, and is spread in a thin film on the chain. Brush sizes are: 5/8 in., 1 in., and 1½ in. dia., and 3/8 in. x 2¼ in. rectangular. Bristle is horsehair, nylon, or stainless steel. System can be either manual or automatic.

Oil-Rite Corp., Manitowoc, Wis.

Circle No. 205 on Reader Service Card

Pneumatic control

The Servotran variable speed drive can be fitted with a diaphragm for vacuum or pressure control, for process control applications or for conversion from pneumatic to mechanical systems. Speed control over



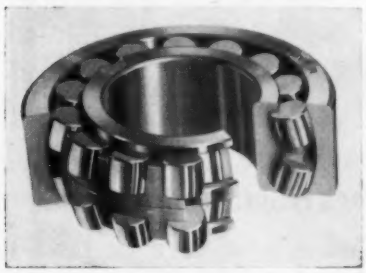
the range from full speed forward to full speed reverse is achieved with a pressure range of approximately 0 to 10 in. of water. The variable speed drive sizes range from the subminiature 1/1000 to 1/100 hp range up to 1/10 hp. A ¼ hp model is offered for smaller speed ranges.

Humphrey, Inc., Humphrey Products Div., San Diego, Calif.

Circle No. 206 on Reader Service Card

Spherical roller bearings

Raceways and rollers of these spherical roller bearings are said to have working surfaces of exceptional, mirror-like smoothness for longer bearing life and superior performance. They have a double row of

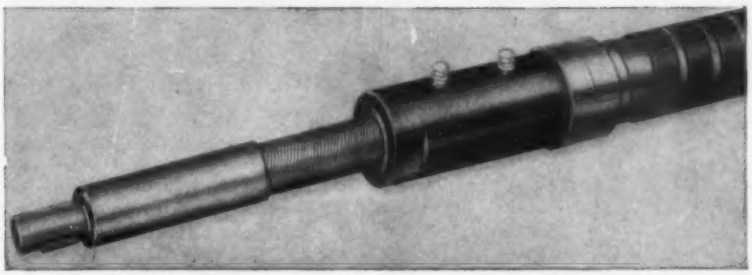


large rollers to accommodate heavy radial and shock loads. High contact angle provides substantial thrust capacity in either direction. A single spherical outer raceway permits the bearings to compensate automatically for shaft misalignment in any direction, either initially or dynamically under load. There's a complete range of series and sizes, with both cylindrical or tapered bore.

Hoover Ball & Bearing Co., Ann Arbor, Mich.

Circle No. 207 on Reader Service Card

HOW TO SELECT FLEXIBLE SHAFTING FOR POWER DRIVE APPLICATIONS



1¼-inch STOW Power Drive flexible shaft with core assembly pulled out of casing.

For Power Drive applications, the following factors must be considered:

1. **Torque (Lb. In.)** to be transmitted (The starting torque should be used in making selections.)

2. **Operating Speeds (RPM)** — If the maximum speed is higher than the rated speed, torque ratings in the table below do not apply. To find the torque capacity for flexible shafts operating at speeds higher than the rated speeds, multiply the maximum dynamic torque capacity by the rated speed, and then divide by the operating speed. (See example.)

3. **Operating Radius** — In making the selection from the table below, the radius of the smallest bend in the flexible shaft should be used.

Ratings — The ratings for flexible shafts shown in the table below apply under the following conditions:

1. When the flexible shaft is adequately supported by clamps along its length. (For unsupported shafts, multiply the calculated torque by a safety factor of 1.6—see example below.)

2. When the flexible shaft is operated in the wind-up direction, which tends to tighten the outer layer of wires. (Flexible shafts operated in the unwind direction will transmit only about 60% of the rated torque.)

3. When the flexible shaft is in continuous operation. Note: **the ratings are based on temperature rise. When the operation is intermittent, the ratings in the table may be exceeded. Consult Stow engineers for specific recommendations.**

RATED SPEED R.P.M.	MAXIMUM DYNAMIC TORQUE CAPACITY (LB. IN.) STRAIGHT AND CURVED SHAFTS RADIUS OF CURVATURE IN INCHES									Wgt./ C. Ft.	Core Dia.	Core No. and Type	Stock Size
	50 to Strgt.	25	20	15	12	10	8	6	5				
4,500	2.4	2.2	2.0	2.0	1.92	1.9	1.7	1.5	1.25	3.0	124/.128	8049 MH	13
3,800	7.0	6.4	6.0	5.8	5.4	5.0	4.6	3.6	2.0	4.5	148/.152	2081 MH	15
2,900	9.4	8.6	8.0	7.6	7.0	6.6	6.0	4.8	3.4	7.0	185/.189	5108 MH	19
2,500	22.0	20.0	18.8	17.6	16.0	15.0	12.6	10.8	9.0	12.5	.247/.252	8924 MH	25
1,800	30.0	28.0	26.4	25.0	23.0	21.0	18.0	14.0		20.0	.308/.313	8925 MH	31
1,800	33.8	31.5	29.7	28.1	25.9	23.6	20.2	15.8		20.0	.308/.313	8969 T	31
1,800	36.0	33.0	31.6	30.0	28.0	26.0	22.0	18.0	11.0	21.0	.324/.329	2034 A	31
1,500	80.0	66.0	63.0	58.0	51.0	46.0	37.0	22.0		28.5	.368/.374	2035 A	38
1,500	60.0	54.0	50.0	46.0	42.0	38.0	30.0	24.0		29.0	.387/.393	8970 MH	40
1,500	90.0	81.0	75.0	69.0	63.0	57.0	45.0	36.0		29.0	.387/.393	8971 T	40
1,150	136.0	110.0	104.0	94.0	80.0	72.0	56.0			50.5	.497/.503	8999 A	50
1,150	148	124	110	92	72	56				53.5	.505/.511	6940 T	50
900	248	200	176	124	84					78.5	.610/.618	6997 T	63
900	220	204	192	180	152	130				80.5	.630/.638	7731 A	63
750	340	224	156	76						117	.747/.753	2056 T	75
600	760	520	420							205	.998/1.004	2057 T	100
440	1,500	720								343	1.298/1.304	2058 T	125

EXAMPLE: How to use the table:
The problem is to transmit ½ HP at 1700 RPM through an unsupported flexible shaft in a 25" radius, estimated starting torque 150% of normal operating torque.

1. Calc. Torque (lb. in.)—

$$\frac{HP \times 63000}{RPM} = \frac{.5 \times 63000}{1700} = 18.5$$

2. Correction factor for starting torque 1.5 x 18.5 = 27.75

3. Correction factor for unsupported shaft 27.75 x 1.6 = 44.4 lb. in.

4. Refer to Table above. Read downward in column under 25" radius until you find a core having a rating of at least 44.4 lb. in. In this case we find that core No. 8970 is rated 54 lb. in. at 1500 RPM. Since the given speed is 1700 RPM, multiply 54 by 1500 and divide by 1700. 54 x 1500 ÷ 1700 = 47.6 lb. in. (rated torque at 1700 RPM). Therefore, Core No. 8970 is correct.

For Engineering Bulletin No. 570 and a free torque calculator, write

STOW

STOW MANUFACTURING COMPANY

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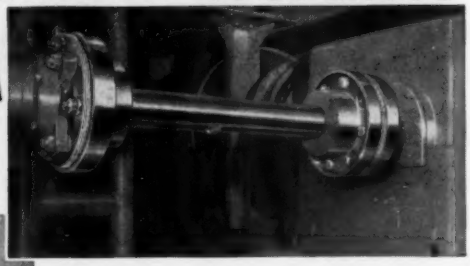
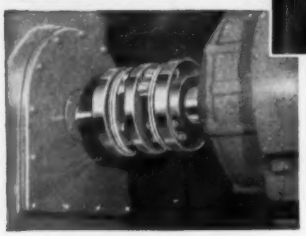
Circle No. 45 on Reader Service Card

For Power Transmission Without Maintenance Use

THOMAS FLEXIBLE COUPLINGS

NO LUBRICATION
NO MAINTENANCE
NO WEARING PARTS





Thomas' 40 years of flexible coupling experience is at your disposal to help you meet ordinary applications or special variations for unusual cases.

Under Load and Misalignment only Thomas Flexible Couplings offer all these advantages:

1 Freedom from Backlash Torsional Rigidity
2 Free End Float
3 Smooth, Continuous Drive with Constant Rotational Velocity
4 Visual Inspection While in Operation
5 Original Balance for life
6 No Lubrication
7 No Wearing Parts
8 No Maintenance

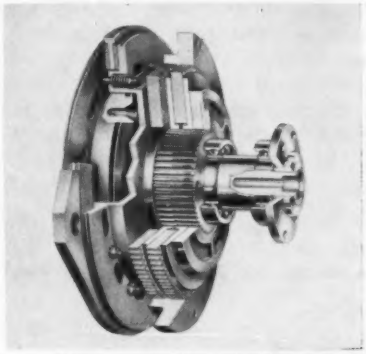
Write for engineering catalog 51A, and the name of your nearest Thomas representative

THOMAS FLEXIBLE COUPLING COMPANY
WARREN, PENNSYLVANIA, U.S.A.

PRODUCTS *continued*

Air friction clutch/brake

Combination air friction clutch and brake can be used where controlled single or multiple cycling within a wide range of speed is desired. It's adaptable for mounting on crank, cam, or drive shaft for flywheel or geared application. It can be used with flywheel, gear, or drive-spider and mounted outboard or between bearings. A pressure plate acts as both clutching and braking member. Air pressure moves the plate to engage the clutch discs in one direction and spring pressure moves it in



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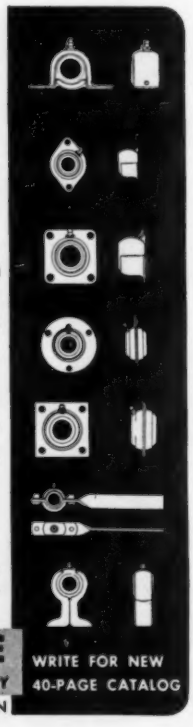
SELF-ALIGNING
SLEEVE TYPE
BEARINGS

STANDARD▲
OR
◀SPECIAL

Routine or unusual — let us help with your bearing or bearing mounting problems. 20 years' experience furnishing new ideas and quality bearings at low cost to leading mechanical equipment manufacturers.

Creative design and engineering...
making our products better today . . . so yours may be better tomorrow.



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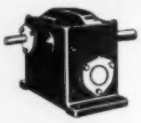
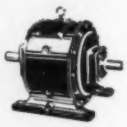
Abart SPEED REDUCERS

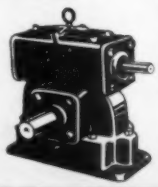
Designed and Constructed for Continuous Rugged Service



trouble-free, economical drives for any speed reduction need



Compact, precision built Abart units are available in a wide range of models from fractional to 168 hp. ratings, ratios to 10,000 to 1.



Worm, spur and combination gear models — single or double reduction — are supplied in 75 different types and sizes with any desired shaft arrangement.

Write today for Abart's hand pocket size speed reducer catalog.

ABART GEAR and MACHINE CO.
4833 WEST 16th STREET • CHICAGO 50, ILLINOIS
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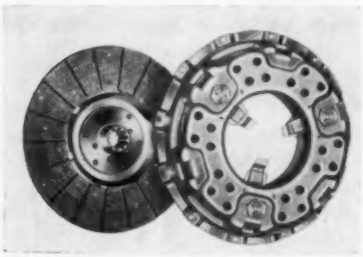
the opposite direction to apply the brake as the air exhausts.

Minster Machine Co., Minster, Ohio.

Circle No. 208 on Reader Service Card

Direct pressure clutch

A 15-inch direct pressure heavy-duty clutch is said to produce greater torque at least weight for diesel engines. It's available in single or two-plate models which may be used with pot or flat fly-wheels. Torque range is from 925 to 1295 ft-lb static torque for single plate to 1850 to 2600 ft-lb static torque for two-plate. Cylindrical



pressure springs are made of chrome silicon steel and are used with insulating washers to provide greater heat resistance, lower fade rate. No internal adjustments are needed for facing wear, as adjustments are made at pedal linkage.

Lipe-Rollway Corp., Clutch Div., Syracuse, N. Y.

Circle No. 209 on Reader Service Card

Inexpensive diaphragm brake

An inexpensive low-torque diaphragm brake is said to give accurate tension control for applications requiring 1600 in.-lb or less of torque. It's self-adjusting for wear, has low inertia, and has linings that

can withstand high speeds. The air diaphragm has a ¾-in. stroke. Operation is manual or automatic.

Horton Mfg. Co., Inc., Minneapolis, Minn.

Circle No. 210 on Reader Service Card

Medium-duty pulley

A medium-duty pressed-steel pulley is said to combine the features of cast and welded steel pulleys. A rolled steel flange around the rim of the wheel locks in the groove angle. The hub is multi-swaged to the rim for high-torque strength, and the hub is countersunk to eliminate burr problems. Wider wheel spokes with deep embossments give overall strength. Wheel halves are precision welded together for greater regularity.

Barke Products Inc., Bay Village, Ohio.

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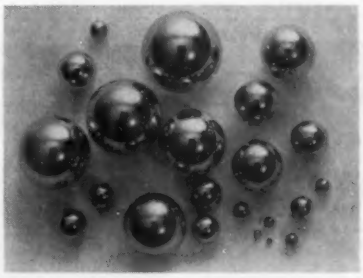
Tungsten carbide balls

High-precision tungsten carbide balls are available from stock in 32 standard sizes. They are AFBMA



Grade 25, of .000025 in. sphericity, ±0001 in. basic size tolerance, and .000050 in. uniformity per container. Hardness is 89-91 Rockwell A, and they can be used in bearings at temperatures to 800F. Surface finish is 1 microinch.

Industrial Tectonics, Inc., Ann Arbor, Mich.

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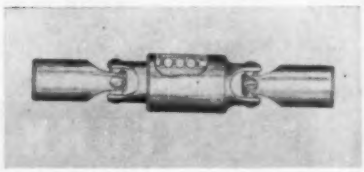
Zero-backlash joints

Telescoping miniature universal joints are said to allow greater



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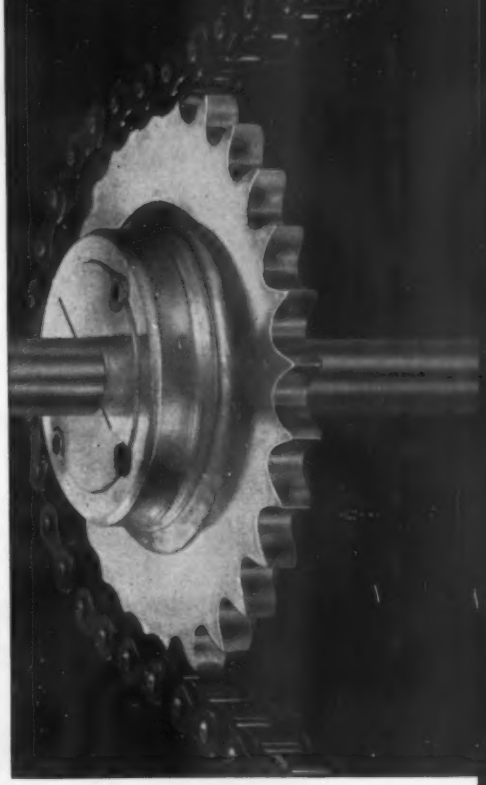
Another PLUS value...

CUT RIGHT...
NOT
"CUT RATE"



Sprockets that are *not* cut right can cut chain life by as much as 50% to 75%. For smoothest action...for maximum service life of both chain and sprockets, cut-tooth sprockets must be made to precise tolerances. Rex Cut-Tooth Sprockets are made to exact tolerances to fit precisely with the chain for longest life of both chain and sprockets. For more data, mail the coupon.

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CUT-TOOTH SPROCKETS

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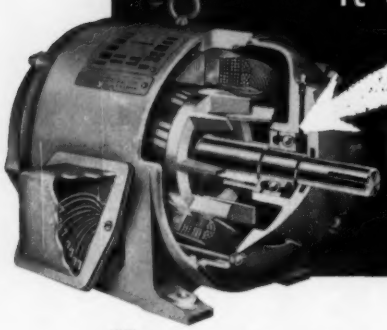
If it doesn't have it here—
it doesn't have it!
and the
BROOK MOTOR
has it!



MANY MOTORS look practically alike on the outside, but it's what is inside that counts. There is no motor with better windings or more ample bearings — few motors compare favorably. Yet, the Brook Motor costs less, because of volume production, modern techniques, distribution in 76 countries and a realistic pricing policy. Brook Motors have established excellent performance records for over 56 years in every industry using a.c. motors. From 1 to 600 H.P. Send for literature.

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PRODUCTS *continued*

freedom in designing systems where precise transmission of information is essential. Two preloaded ball splines provide lateral travel and minimum thrust on connected components. The joints have sealed-in lubrication of preloaded bearing surfaces between burnished sockets and precision balls giving continuous contact. This design is said to assure zero backlash for the entire assembly. Body components are of 303 stainless steel, balls are of 440 stainless.

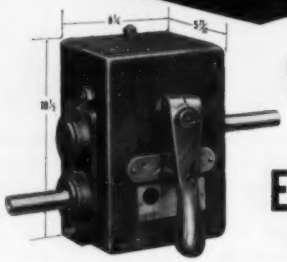
Falcon Machine & Tool Co., Cambridge, Mass.

Circle No. 213 on Reader Service Card

Miniature tach generator

This miniature tachometer generator has been designed and tested under MIL-G-26611. A two-pole 3-phase Y-connected stator and the permanent magnet rotor furnish alternating 3-phase output power with frequency proportional to rotor velocity. It's capable of 14 watts output at 4200 rpm. The magnet is

NOW available from stock!



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3 SPEED
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INPUT SPEED - 1800 RPM

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This Compact
FUNK Unit
SAVED
Space

On this Jaeger concrete mixer, a FUNK-designed double right angle drive provides perfect alignment and positive chain adjustment. Mounted vertically on the "unitized" front trunnion stand, FUNK's unit takes up only a fraction of the space normally used in such applications.

Just one example of how FUNK MODULAR POWER UNITS may be combined in an unlimited number of arrangements — *without* special engineering costs.

Let FUNK solve your power transmission problem.

FUNK MFG. CO. Box 577-G Coffeyville, Kansas

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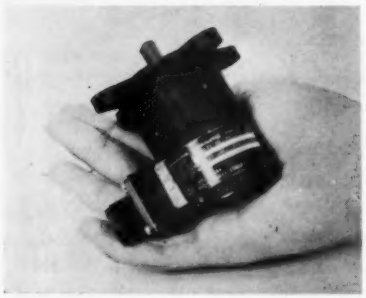


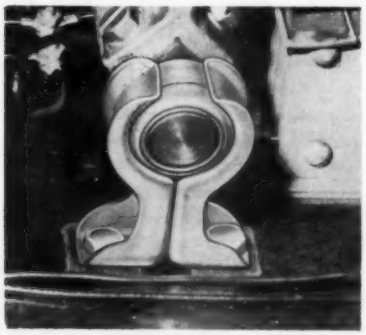
cast on the rotor shaft for added strength, and oversize ball bearings are used for long life.

Globe Industries, Inc., Dayton, Ohio.

Circle No. 214 on Reader Service Card

Economical pillow block

A self-aligning pedestal-type pillow block is a stamped support with double-channel cross section to pro-



vide an economical and sturdy mounting for sleeve bearing ball units. A ball and socket combination for self-alignment speeds assembly time by eliminating shimming or machined surfaces.

Triangle Mfg. Co., Oshkosh, Wis.

Circle No. 215 on Reader Service Card

Low-cost pulleys

A line of low-cost variable speed pulleys has been developed for original equipment and for replacement on existing equipment. Five sizes range from fractional to 1 hp,

with speed ratios up to 2.8:1. Construction includes curved pulley faces for full belt contact, high ratio for small face diameter, positive lubrication, and compact, lightweight construction.

Lovejoy Flexible Coupling Co., Chicago, Ill.

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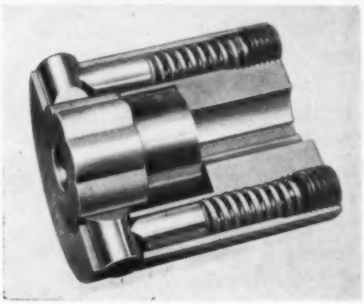
Torque coupling

A torque disconnecting coupling has a W-shaped detent which makes it possible for one spring to both resist the torsional forces up to the point of disconnection and then to



throw the torque-carrying elements well out of engagement. It can be adjusted quickly within a wide range of torque values, and is readily reset after disconnecting.

Odin Corp., Castleton, Ind.

Circle No. 217 on Reader Service Card

Magnetic readout encoder

A shaft-position digital encoder with 13 bit binary output employs a noncontacting magnetic readout. This

permits its operation in any environment, at speeds up to 10,000 rpm, and with any number of readouts without effect. Only passive circuitry is involved in readout.

ASCOP, div. of Electro-Mechanical Research, Inc., Princeton, N. J.

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Another PLUS value...

PREMIUM CHAIN
...NO EXTRA COST

Rex Roller Chains are designed to give you longest possible wear life. For example, as shown above, all standard roller chains have oil holes in the bushings to assure easy penetration of life-adding lubricant to the important pin-bushing contact area...a vital factor, particularly on high-speed drives. You get many more cycles of wear life...a PLUS VALUE premium chain at no extra cost. For complete information, mail the coupon.

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Another H&S Speed Reducer

on a tough job...

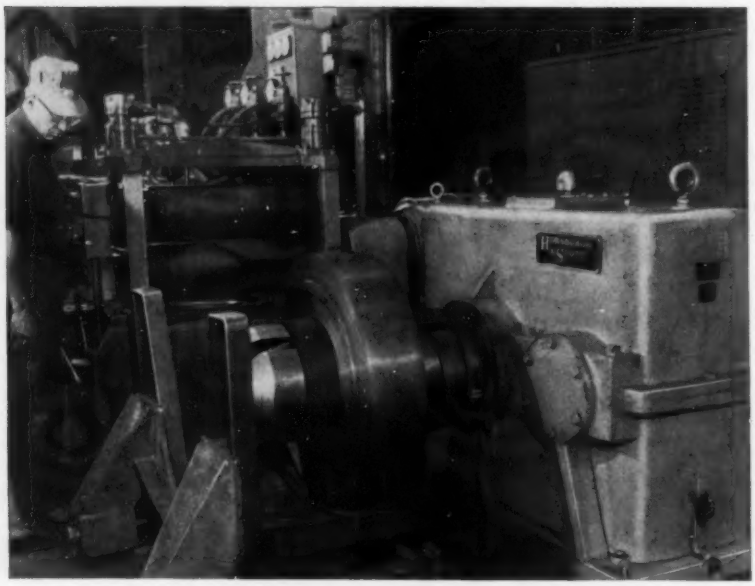
Built rugged for a critical rewind operation, this heavy overhung-load type H & S Herringbone Speed Reducer delivers day-in-day-out service under exacting load conditions.

This standard unit was selected for use on a Bliss precision rewind coiling machine—where strip steel must undergo tension controlled recoiling for subsequent annealing treatment.

Notice the sturdy shaft, with heavy-duty bearings designed to take this heavy overhung load. Observe the rugged housing, made to last.

This built-in toughness typifies H & S construction—on helical, herringbone, worm and combination units.

Send for detailed information on our facilities for producing a complete line of gears and speed reducers in a wide range of sizes and ratings.



Heavily loaded pay-off reel being driven by H & S Speed Reducer in plant of The Acme Steel Company, Chicago.

The HORSBURGH & SCOTT CO.

5112 Hamilton Avenue • Cleveland 14, Ohio

Specializing in fast production of quality Speed Reducers and Gearing to meet custom requirements.

Circle No. 26 on Reader Service Card

continued from page 18

Falk promotes four in sales division

MILWAUKEE, WIS.—The Falk Corp. has announced a series of promotions in its sales division. Don K. Lambert, former manager of distributor sales, is now manager of export sales. Succeeding him as manager of distributor sales is Anton R. Peroutka, formerly assistant manager. Franklin C. Williams moves from sales to manager of the marketing division, and Clifford W. Dorman from sales to manager of standard products sales.

Twin Disc plans power-shift boxes

RACINE, WIS.—Twin Disc Clutch Co. has established a Transmission Engineering Dept. in Rockford, Ill., to design torque converter-equipped power-shift transmissions for the industrial market. Twin Disc plans to produce a complete line of boxes from 80 hp up, some of which are expected to be available this fall.

A-C sells part of line

MILWAUKEE, WIS.—Allis-Chalmers Mfg. Co. has sold and transferred certain *Texrope* V-belt drive products to Machinery Sales Corp., New Bedford, Mass.

Included are inventories applicable to *Magi-Key* adjustable sheaves, A-B section *Magic-Grip* stock sheaves; C section *Magic-Grip* stock sheaves, 3 through 6 grooves; D section *Magic-Grip* stock sheaves, 5 through 7 grooves; *Magic-Grip* bushings sizes 1C, 1D, 1E, 2, 4, 5, 6, and certain 7 bushings; and V-belts, A, B, C, D, E, and fractional horsepower sizes both standard and high capacity types.

The trademarks *Magic-Grip* and *Magi-Key* have been assigned to Machinery Sales, which will manufacture and sell *Magic-Grip* sheaves and bushings as a standard item.

New IEC recommendation on motor standards

NEW YORK, N. Y.—The International Electrotechnical Commission has issued IEC Publication No. 72-1, *Rec-*

ommendations for the dimensions and output ratings of electric motors, Part I: Foot-mounted induction motors with shaft heights between 56 and 315 millimeters (2⅝ and 12½ inches).

The new edition has the status of an official IEC standards recommendation. It's available at $2.40 a copy from the American Standards Association, Dept. PR 117, 70 East 45th St., New York 17, N. Y. The U. S. National Committee of the IEC is an arm of ASA.

Bendix buys Elmag

ELMIRA, N. Y.—A line of electromagnetic clutches and brakes will be manufactured by the Eclipse Machine division of Bendix Aviation Corp. The line, the Bendix Elmag, was purchased from the Elmag division of McCauley Industrial Corp., Dayton, Ohio.

The purchase includes tools, patents, goodwill, and a license agreement with the German manufacturer of electromagnetic clutches, Maschinenfabrik Stromag GmbH.

Dr. Walter Rudisch, former McCauley vice president, has joined the Bendix staff as chief engineer—clutches.

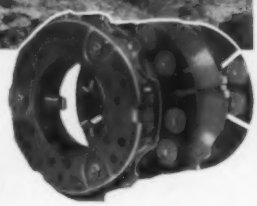
Ray M. Ring has new bearing division

CHICAGO, ILL.—Ray M. Ring Co., Inc., has established a separate bearing and power transmission division, Bearing Headquarters Co. Headquarters of the division will be in Chicago, with branches in Peoria, Waukegan, Rockford, Morton Grove, and East Chicago.

Heads new GE groups

NEW YORK, N. Y.—General Electric Co., which recently reorganized its Apparatus and Industrial Group into an Industrial Group and an Electric Utility Group, has appointed Arthur F. Vinson group executive of the Industrial Group. Clarence H. Linder is group executive for the Electric Utility Group. Vinson is a vice president and formerly group executive of the Apparatus and Industrial Group; Linder is a vice president and formerly in charge of engineering services.

ROCKFORD



MORLIFE® CLUTCHES

TRANSMIT GREAT POWER

Compared to previous type clutch facings, Morlife® Clutch facings reduce foot pedal pressure up to 50%. They assure positive engagement—with power-holding grip. Provide a degree of heat resistance and dissipation never before available. They give several times the durability for prolonging clutch life and extend the time between pedal adjustments many times as long. All levers and other component parts of ROCKFORD CLUTCHES, such as rollers and pins, are made of high quality materials with close dimension and precision workmanship. All parts have more than adequate tensile strength and are properly heat treated for required hardness to withstand the severe service when transmitting great power. Let ROCKFORD clutch engineers show you how these new advantages will improve the operating ease and prolong the on-the-job life of *your* product.

SEND FOR THIS HANDY BULLETIN

Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

Small Spring Loaded

Automotive Spring Loaded

Heavy Duty Spring Loaded

Oil or Dry Multiple Disc

Heavy Duty Over Center

Light Over Center

Power Take-Offs

Speed Reducers

ROCKFORD CLUTCH DIVISION BORG-WARNER

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CLUTCHES

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whatever may be your problems

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Why pay more for a bearing or part than you have to? Let Bunting help you get your requirements down on the lowest cost level compatible with adequate performance.

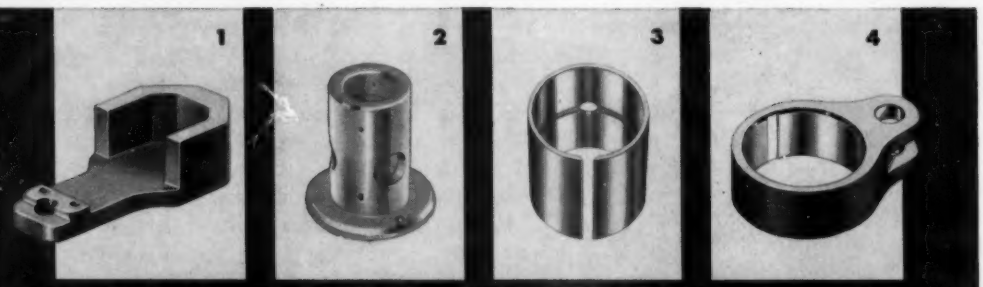
Today and tomorrow "the best" bearing means one that will do the job at the lowest possible cost. Let Bunting help you find the best bearing.

Bunting offers a highly competent designing, engineering and manufacturing facility operating in the field of bearings and special parts.

All modern proven materials are available, others are under study. Two plants with advanced equipment—of our own design—assure absolute production control and lowest manufacturing cost.

Let us re-examine your current bearing applications, or work with you on new requirements. Send in your prints for study and pricing. No cost nor obligation.

CASE IN POINT



1 The great and diverse cost advantages of powder metallurgy are revealed in the highly complex nature of this bearing support plate for power tools made in Bunting's Powdered Sintered Metals Plant.

2 An Aluminum Alloy helped cut the cost of this high speed turbo super charger bearing with its intricate machining of many dimensions and close tolerances.

3 Bunting exclusive methods and equipment reduced to the minimum the cost of this cast bronze spindle bearing with its extremely rigid specifications.

4 This connecting rod demands a fine profilometer reading on the finish of the bores in the two holes, axes of which must be parallel to each other within extremely close limits. Bunting makes such high precision work feasible cost-wise.

MACHINING SERVICE: Emergency service machine shops in Bunting Branches are there to render immediate low cost service on bearings or parts needed for experiment or maintenance. Your local Bunting Distributor can arrange for such service.

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No. 1 . . . ENGINEERING HANDBOOK OF POWDER METALLURGY—A comprehensive technical treatment of engineering and manufacturing of sintered metals, bearings and parts.

No. 158—GENERAL CATALOG—Complete listings of Cast Bronze and Sintered Bronze Stock Bearings and Bars and Bunting Bearing Aluminum Bars available from stocks of local distributors all over America.

THE BUNTING Brass and Bronze Company · Toledo 1, Ohio · Phone EVergreen 2-3451

BEARINGS, BUSHINGS, BARS AND SPECIAL PARTS OF CAST BRONZE, SINTERED METALS OR ALUMINUM ALLOYS

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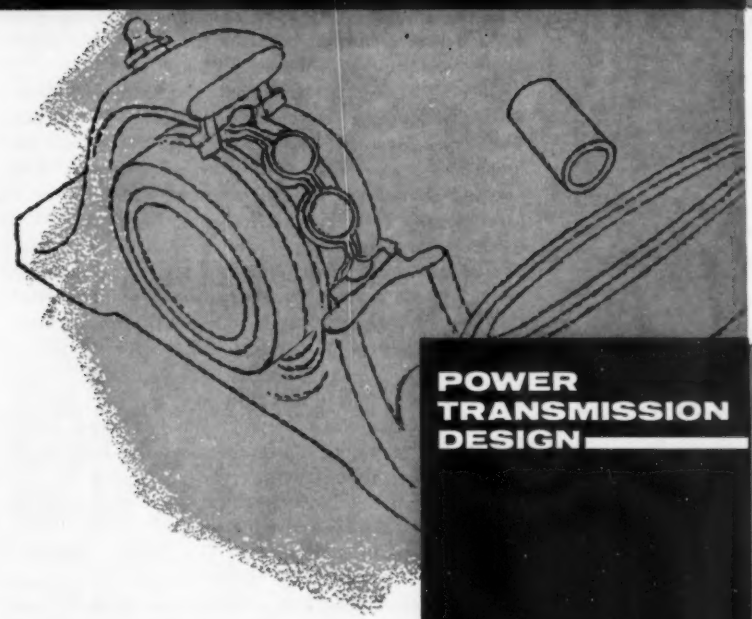
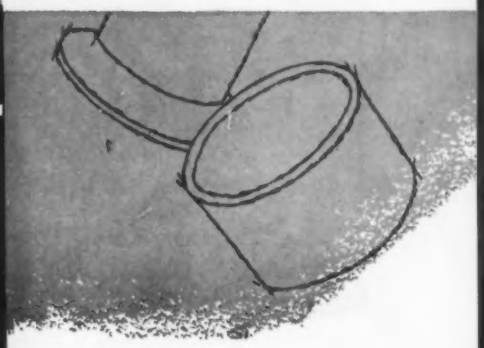
BEARINGS

DESIGN/APPLICATION

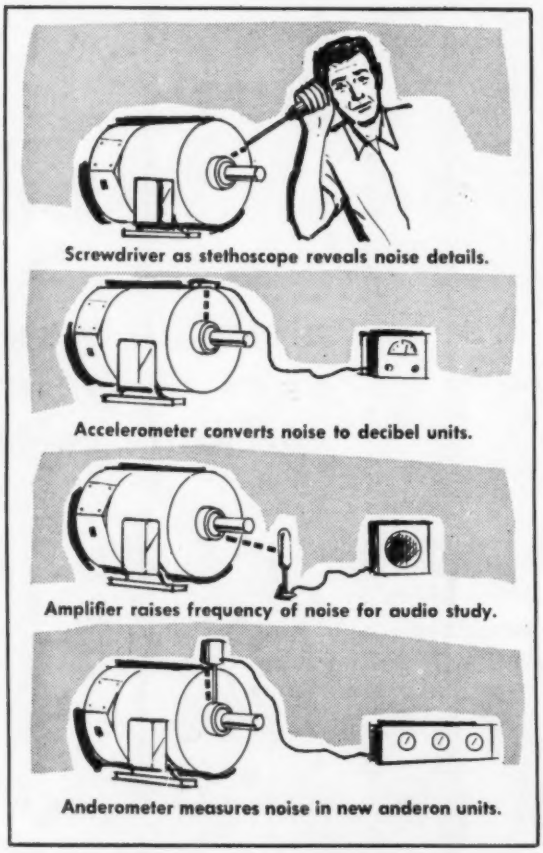


REGULAR MONTHLY SECTION OF IDEAS AND DEVELOPMENTS

POWER TRANSMISSION DESIGN



AGGREGATE bearing noise in large installation must be kept low as possible, like aggregate gear noise.


Screwdriver as stethoscope reveals noise details.
Accelerometer converts noise to decibel units.
Amplifier raises frequency of noise for audio study.
Anderometer measures noise in new anderon units.

Bearing noise

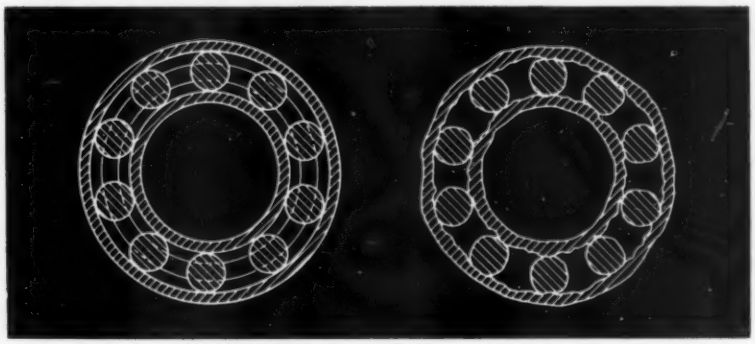
ALL BEARINGS make noise. Like gears, some are noisier than others. By comparison, bearings generally make less noise than gears and other rotating parts and have thus been overlooked for years as a source of general equipment noise.

Bearing noise can be detected several ways. Some ways are depicted roughly in the adjoining drawings. The screwdriver method is still one of the best and quickest ways to analyze intimate noise details inside rotating equipment. Engineers have used this practice for years.

The screwdriver method, however, does not measure precise units of noise. Decibel units of vibration (noise) are a more accurate measure for correlation. Decibels can be accurately measured and recorded with various types of pickups, amplifiers and recorders. Noise levels can be tabulated on oscillographic charts or on meters in this fashion.

Engineers for years have mistakenly used ABEC and RBEC tolerance limitations as noise limitations. The drawings above show why this cannot be. The ABEC-1 bearing on the left, with much wider tolerances than an equal ABEC-5 bearing on the right, has highly finished balls and races. The higher precision ABEC-5 bearing actually meets tighter dimensional tolerance standards. But, ABEC standards do not specify surface geometry as a criterion.

By ANTHONY J. RUFINI, *assistant head engineer, Bearings, Machinery Div., Bureau of Ships, Department of Navy*



ABEC tolerance is not noise tolerance. ABEC-1 bearing at left is quieter than ABEC-5 bearing at right, because of better surface geometry (exaggerated).

is often louder than you think

Noise is vibration. Vibration is noise. The less vibration, the less noise. Elimination of vibration cuts down on noise. In bearings, more select assembly often is all that is required along with closer control of imperfections to produce quiet operation.

You can specify noise limits for bearings from any manufacturer. The *Bureau of Ships* has a strict noise specification which has recently been amended with tighter restrictions. This came about after exhaustive tests on shipboard and land-based equipment in which bearing noises were evaluated. The result: *bearings are noisier than you think—but you can get quiet ones just as easily as noisy ones depending on your specifications to the manufacturer.*

Noise in Ball and Roller . . .

. . . bearings is caused by race waviness, race curvature, surface finish, variations in ball and roller size, eccentricity, groove wobble, ABEC and RBEC precision called for, mounting fits and practices, bearing material, cage material and configuration, type of lubricant and type of loading.

Noise in Sleeve

. . . bearings is caused by stiffness of fluid film, incomplete film lubrication, surface finish, cavitation, turbulence, oil splash, geometry of bearing, grooving, L/D ratio, clearance and oil feed.

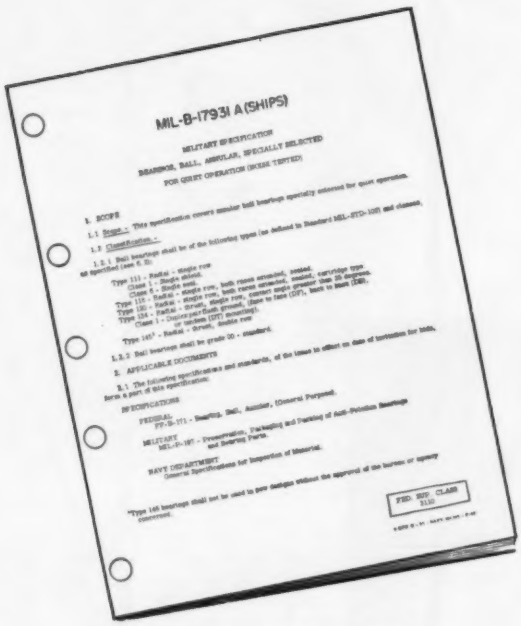
Decibel vs Anderon

Two units of noise are the decibel and a new unit called the anderon. The decibel is a measure of relative loudness. It is the smallest degree of difference of loudness detectable by the human ear, the range of which is about 130 decibels. Speech is about 60 decibels above sounds that are barely audible. A decibel is always relative to an established base. Electrically, it is a logarithmic expression of ratios of power, voltage or current.

The anderon is a unit measured on a specific machine called an Anderometer. The Anderometer consists of three basic parts shown in the schematic. The motor-driven spindle rotates the inner ring of the bearing at a constant speed of 1800 rpm. A converter is mounted on a vertical slide above the spindle. It is held against the top of the non-rotating ring by spring pressure. It translates the radial movement of the outer ring into a small fluctuating voltage as the inner ring rotates.

The anderon converter is a velocity-type pick-up in which output doubles as frequency doubles.

continued on next page



MIL-B-17931 A(SHIPS)

MILITARY SPECIFICATION

BEARINGS, BALL, ANNULAR, SPECIALLY SELECTED FOR QUIET OPERATION (METRIC SERIES)

MIL-SPEC has recent (August, 1959) amendment covering permissible noise level of ball bearings.

BEARING NOISE *continued*

The converter formula is

$$E = \frac{DF}{C} \quad \text{.....(1)}$$

where

C = constant found by experiment
E = converter voltage output in microvolts
D = displacement in microinches
F = frequency, 60 cps

An Anderon is the angular derivative of the radial displacement of the stationary outer race as the inner race rotates in microinches/radian (1800 rpm).

Thus,

$$\text{Anderon} = \frac{V}{N} \quad \text{.....(2)}$$

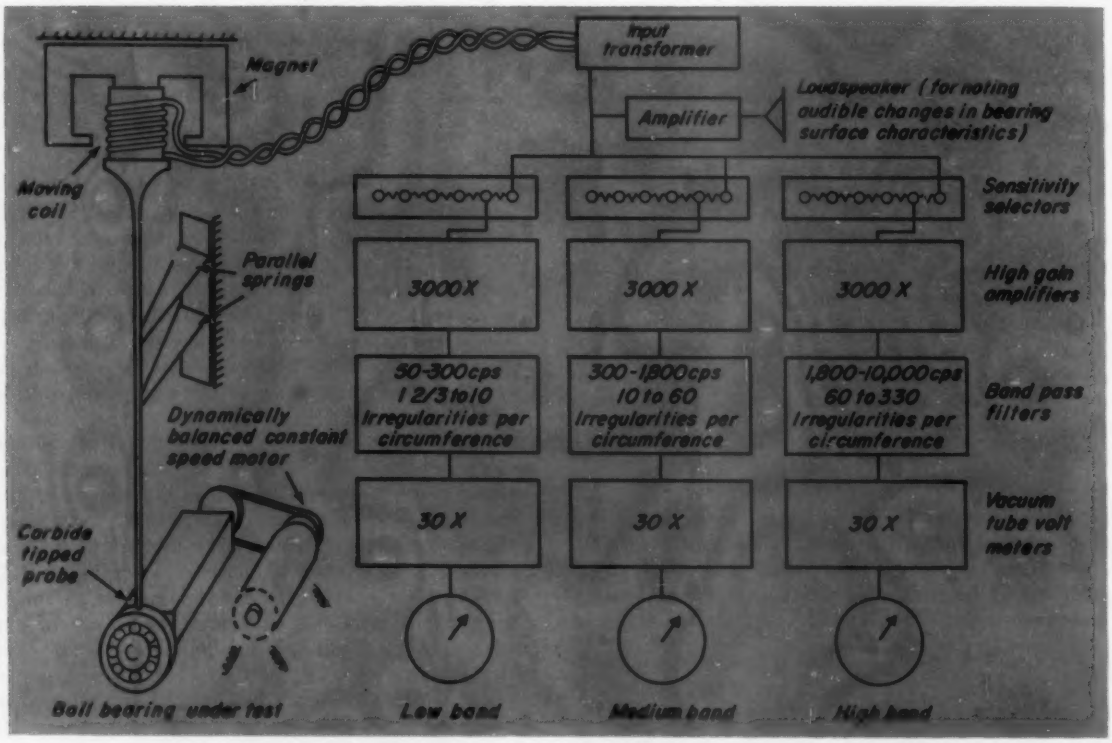
where

V = velocity (RMS) in microinches/radian (for 1800 rpm)

$$= \frac{\text{displacement (RMS) x } 2\pi \text{ frequency}}{60\pi}$$

$$= \frac{\text{displacement (RMS) x frequency}}{30}$$

N = number of octaves/band pass to the ½ power ($\sqrt{2\frac{1}{2}}$ or 1.58)



NEW ANDERON UNIT of noise is angular derivative of radial displacement of outer ring as inner ring rotates in microinches per radian at 1800 rpm.

Example 1

What is the peak-to-valley vibration of 112 microinches (40 microinches RMS) at 60 cps?

Solution 1

$$\text{Anderon} = \frac{40 \times 60}{30 \times 1.58} = 50$$

Example 2

What is the peak-to-valley vibration of 112 microinches (40 microinches RMS) at 60 cps and a peak to valley vibration of 56 microinches (20 microinches RMS) at 120 cps?

Solution 2

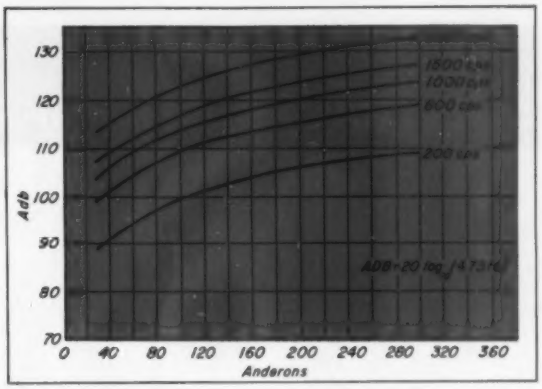
$$\text{Anderon} = \sqrt{\left(\frac{40 \times 60}{30 \times 1.58}\right)^2 + \left(\frac{20 \times 120}{30 \times 1.58}\right)^2}$$

$$= \sqrt{50^2 + 50^2} = 71$$

Despite bearing appearance and how it is manufactured, balls and raceways are never geometrically perfect. Instead of being absolutely circular, contours include waviness, which varies in height, shape and spacing.

These waves commonly have a peak-to-peak spacing of from 1 deg to 90 deg or more around the circumference, and they range in height from a few microinches to as much as several hundred microinches (millionths of an inch).

When one race rotates with respect to the other, the irregularities produce a complex cam action. This causes one race to move radially with respect to the other, resulting in noise and vibration. The character of the noise and vibration depends on the height, shape and spacing of the waviness irregularities on (1) the inner raceway, (2) the balls, and (3) the outer raceway.



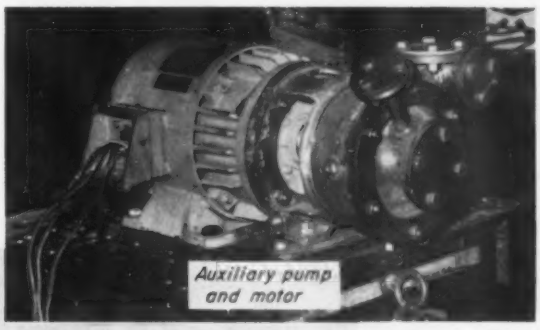
RELATIONSHIP of acceleration decibels to Anderons.

A correlation between Anderons and velocity decibels or accelerometer decibels provides a basis for comparisons. Accordingly, the U. S. Navy Engineering Experiment Station has derived the following formulae

$$\text{Vdb} = 20 \log_{10} [756 \times \text{Anderon value}]$$
$$= \text{velocity decibels} \quad \ldots\ldots (3)$$

$$\text{Adb} = 20 \log_{10} [4.73 \times \text{frequency} \times \text{Anderon}]$$
$$= \text{acceleration decibels} \quad \ldots\ldots (4)$$

▲▲▲



NUCLEAR SUBMARINE has strict noise limitations on all equipment. Need for quiet bearings brought massive industry study in which U. S. bearing manufacturers participated.

New oil seals

BY R. A. HUDSON, *field engineer, Chicago Rawhide Mfg. Co.*

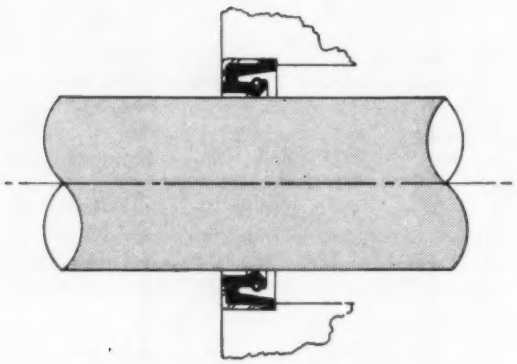


FIG. 1 TYPICAL oil seal installation.

AN OIL SEAL, Fig. 1, must fill the space between a bore and shaft, and seal the space so there is no leakage. However, the shaft is also a very functional part of the whole assembly. It might be thought of as the stopper in the neck of a bottle.

In any discussion of sealing, serious consideration must be given the shaft in addition to the seal. Shaft finish, hardness, and material are all important to the successful operation of a seal. Oil seal and shaft must be compatible and the seal must be properly installed. The shaft must be free of scratches, grind leads and other defects. Shaft periphery must be a perfect circle and the diameter must be accurately maintained. The shaft geometry must let oil reach the seal lip, and the shaft must conduct heat away from the lip.

The Unitized Seal

Realization of this has led to the development of a seal in which the surface, on which the lip runs, is an integral part of the seal assembly, Fig. 2. This is the unitized oil seal.

In the unitized seal, the integral surface against which the lip runs is called a wear sleeve. The wear sleeve has a rubber lining which is a press fit over the shaft. The rubber lining seals the space between the wear sleeve and shaft and also serves as a driver for the wear sleeve. The rubber lining wraps around the edges of the wear sleeve and small projections on it locate the wear sleeve in the outer case. In service, these projections soon wear off and there is no torque drag from them.

Here's a short list of the advantages of the unitized seal, some obvious, some not so obvious.

1. No more worries by the user about shaft finish, hardness, or material.
2. Installation is practically foolproof, and neither sleeve nor lip can be damaged during shipment or installation.
3. Replacing the seal, replaces both wearing surfaces.
4. Lubrication is improved. Oil is trapped within the outer case and the wear sleeve dips into it each revolution to cool and lubricate.
5. No special tools needed for installation.
6. Wear sleeves of special materials such as stainless steel may be used for special applications.
7. Type of lubrication, lubricant temperature, and shaft speed are strictly conventional, not experimental.

Typical Applications

Unitized seals have so far been used on truck rear axles, trailer rear wheels where oil is used for lubrication, power-take-off drives in truck engines, and in a fluid coupling on a fan drive.

In some of these applications, such as the truck and trailer wheels, where the shaft is stationary and

work well on rough shafts

the wheel rotates, a seal with an external lip, Fig. 3, is used. This external seal design has certain advantages in these applications. They are:

1. Molded rubber parts are reduced from two to one.
2. Effect of centrifugal force on the lip is eliminated.
3. More oil is trapped within the seal than in the other design and centrifugal force aids lubrication.
4. Heat is more readily conducted away from the lip through the outer case.
5. Outer case takes the place of the wear sleeve, eliminating this part.

Experience has shown that the untouched surface of the cold-rolled steel used in the outer case is ideal as a contact surface for the oil seal lip. Cases can be produced without scratching or otherwise damaging this surface.

These seals are now being considered for use in a great variety of other applications Automobile pinions and front pump seals in automatic transmissions seem to be points where they could be used to real advantage.

Cost

There is not necessarily any additional cost involved when a unitized seal is used, although the seal assembly itself is somewhat more expensive than conventional seals. There may be real savings from the elimination of shaft grinding and easier installation. Freedom from damage during shipment and installation may also help to lower cost.

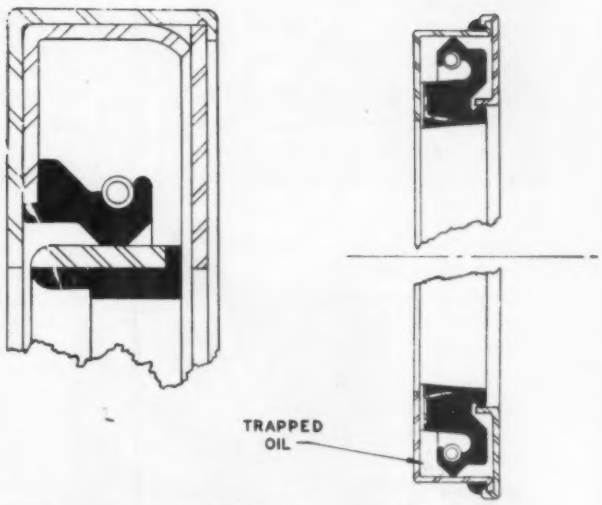


FIG. 2. (LEFT) UNITIZED oil seal. Lip-contracting surface is built in.

FIG. 3. (RIGHT) EXTERNAL-TYPE unitized oil seal. Housing is lip contact surface.

Primary Advantage

The really outstanding advantage of the unitized seal is that responsibility for proper functioning of the oil seal lies with its manufacturer. There can be no buck passing. This should lead to real improvements in oil seal quality. It may also allow refinements in design to be made because the sealing surfaces are mass-produced in the manufacturer's plant, while they would be too costly for the individual user. ▲▲▲

This article was abstracted from a paper presented at the SAE National Transportation Meeting, La Salle Hotel, Chicago Ill., Oct. 26-28, 1959.

LITERATURE on drives and components

INSTANT-REVERSING MOTORS . . . which are said to reverse instantaneously because the switching action is automatically preset by shaft rotation are described in a 4-page bulletin. *Franklin Electric Co., Inc.*, Bluffton, Ind.

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LOW-COST TRANSMISSION . . . available from factory stock in both an increaser and reducer. It's called the Econo-Drive and Catalog No. E33-1000-2-60-5M tells all about it. *Turner Uni-Drive Co.*, Kansas City, Mo.

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CONVEYOR CHAIN MANUAL . . . has been compiled as an engineering handbook for use in selecting chain for conveying and elevating. Correct application, types of attachments, and factors in selecting chains are outlined and illustrated. *Moline Malleable Iron Co.*, St. Charles, Ill.

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FLEXIBLE SHAFT . . . assemblies are shown in an 8-page bulletin which includes more than 180 variations. These standard assemblies are made up from stock components, and can be ordered directly from the catalog. *F. W. Stewart Corp.*, Chicago, Ill.

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WORM REDUCERS . . . selection manual No. SL 487.1 has 28 pages of tables, charts, dimensions, and other data to help select the proper speed reducer for every need. *David Brown, Inc.*, San Leandro, Calif.

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OIL ADDITIVE . . . is said to increase the film strength of lubricating oil, thereby decreasing metal failure due to wear and abrasion caused by higher speeds and greater loads and stresses. Literature tells how it works and shows results of tests. *Bardahl Oil Co.*, Chicago, Ill.

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POSITIVE DRIVE BELT . . . is said to provide versatile applications on drives up to 600 hp, and from speeds under 100 fpm to more than 10,000 fpm. Details on this toothed belt drive are available. *Durkee-Atwood Co.*, Minneapolis, Minn.

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VARIABLE SPEED DRIVES . . . Catalog M-592 has 96 pages of construction features, specifications, speed and rating tables, and pricing information on the complete line of mechanical variable-speed Motodrives. It's available by writing on your company letterhead. *Reeves Pulley Div., Reliance Electric & Engineering Co.*, Columbus, Ind.

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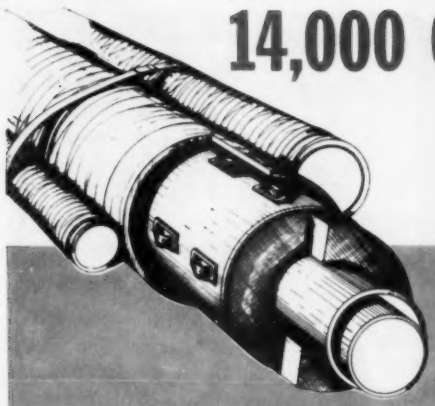

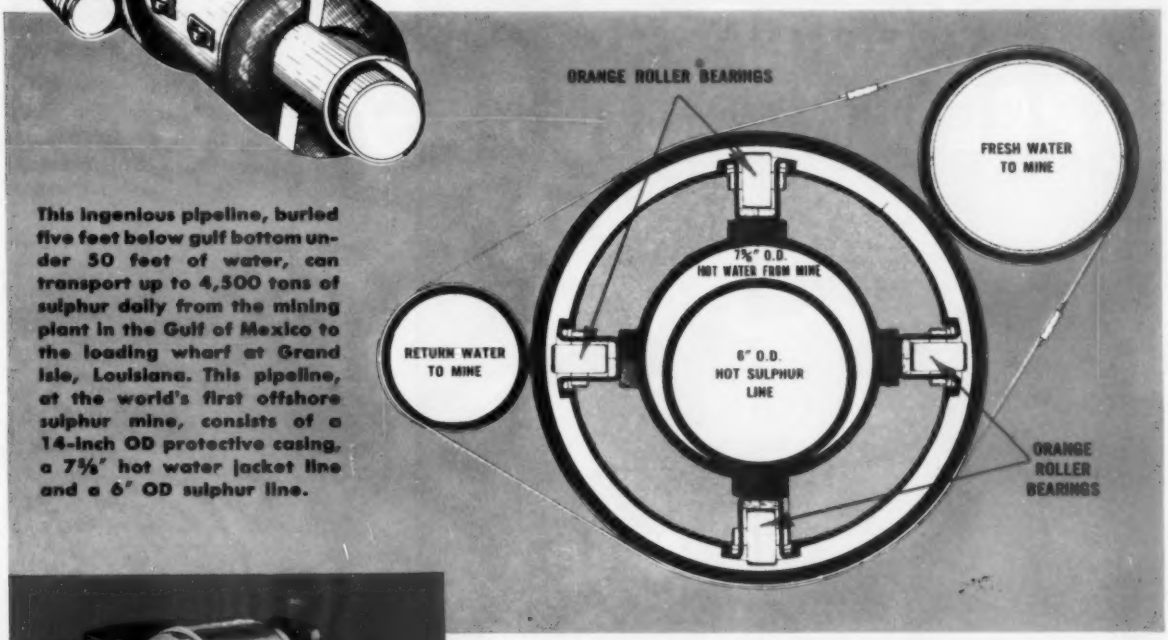
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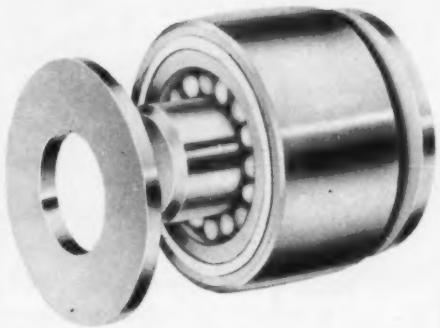

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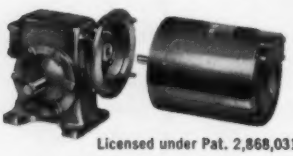

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ROLLER CHAIN . . . technical folder has data on heavy-duty offset side bar roller chain developed for applications where operating conditions are severe. *Atlas Chain & Mfg. Co.*, West Pittston, Pa.

Circle No. 307 on Reader Service Card

RETAINER BEARING . . . engineering data sheet, W-1, gives four pages of information on performance, torque, dimensions, load capacity, tolerances, calibration, and radial play. *Barden Corp.*, Danbury, Conn.

Circle No. 308 on Reader Service Card

V-DRIVES . . . Bulletin No. 9102 gives 36 pages of information on a drive said to reduce overall drive dimensions by as much as 50%, save up to 25% in weight, and save up to 30% in cost over conventional V-belt drives. *T. B. Wood's Sons Co.*, Chambersburg, Pa.

Circle No. 309 on Reader Service Card

CENTRIFUGAL SWITCHES . . . Bulletin No. 244 describes snap-action units said to be virtually frictionless in operation, and which can be used on any device utilizing rotary motion. *Torq Engineered Products, Inc.*, Bedford, Ohio.

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VARIABLE SPEED PULLEYS . . . plus related equipment including compound drives, motor bases and frames, wide V-belts and sheaves are described in a 24-page technical catalog. It includes selection and operating data, horsepower, ratings, dimensions, and representative applications for different sizes and models. *Lovejoy Flexible Coupling Co.*, Chicago, Ill.

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SOLID FILM LUBRICANT . . . is a formulation of molybdenum disulfide, said to be easily applied by spraying, brushing, or dipping. Literature tells how the dried film provides permanent lubrication on all types of rotating and sliding bearing surfaces. *Poly Chem*, Indianapolis, Ind.

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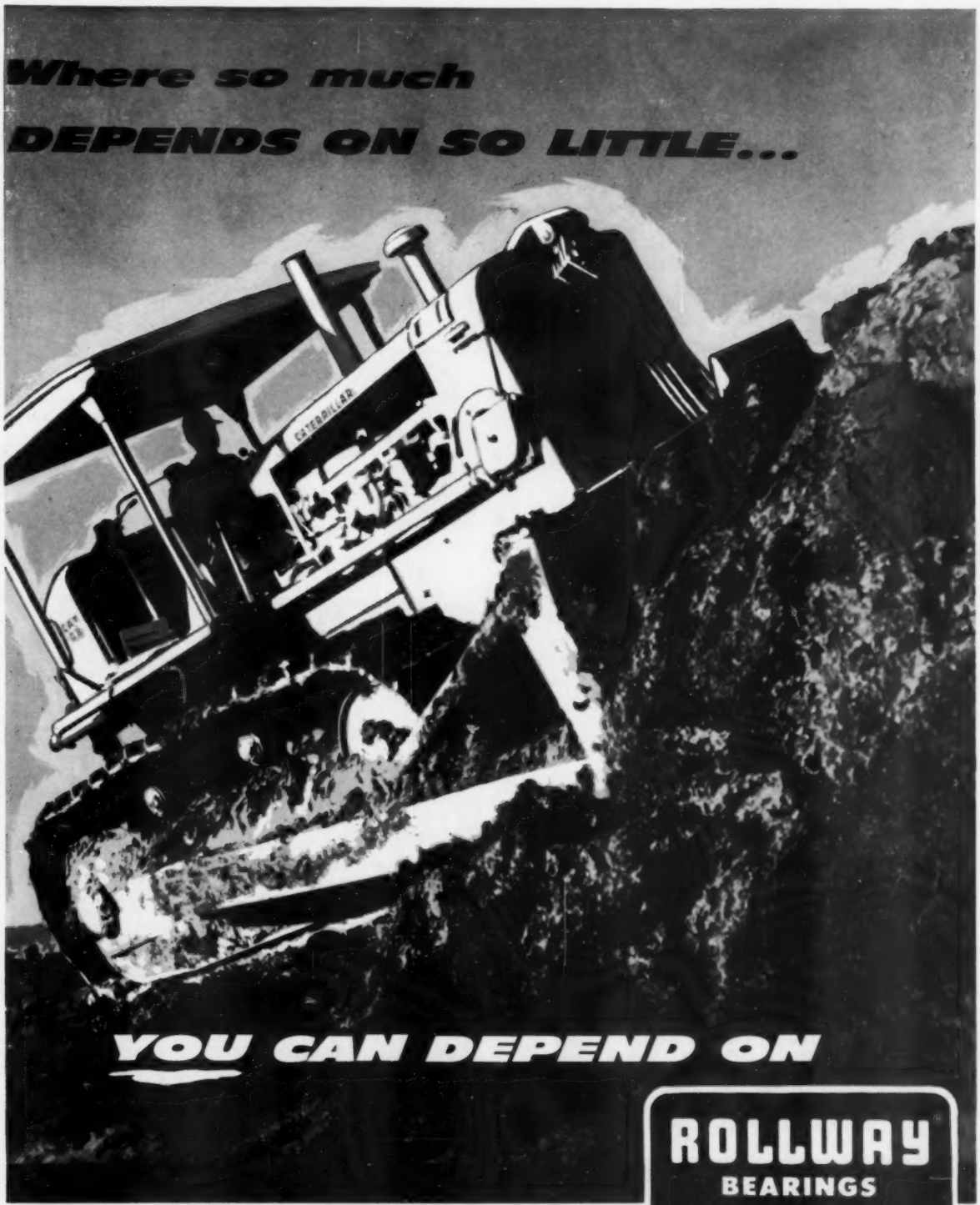

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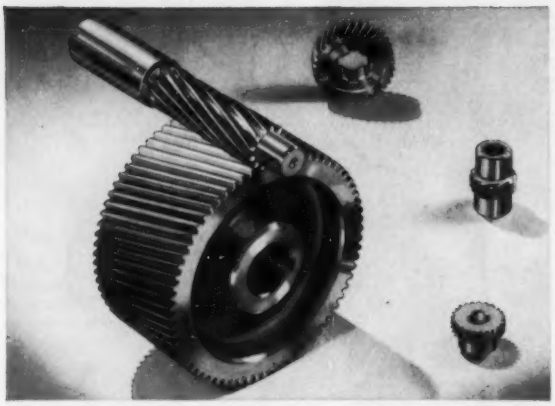

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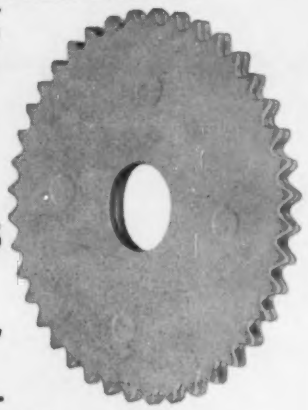

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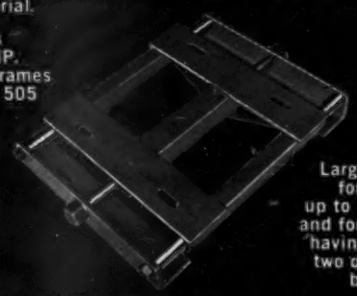

Larger Sizes for motors up to 500 HP. and for motors having one or two outboard bearings.

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LITERATURE *continued*

FLEXIBLE COUPLINGS . . . Engineering Catalog No. 60 includes a discussion on misalignment, a new way to classify loads, and grouping of various types of couplings for easier selection. It has 48 pages. *Thomas Flexible Coupling Co.*, Warren, Pa.

Circle No. 313 on Reader Service Card

DRIP-PROOF MOTORS . . . Bulletin No. 196 describes the new Sterlicone Multi-Shielded motors, illustrating design features and explaining how they can be used under adverse conditions of moisture, humidity, dust, oil, and chemicals. *Sterling Electric Motors, Inc.*, Los Angeles, Calif.

Circle No. 314 on Reader Service Card

MOTION INDICATOR . . . Bulletin RG-21 describes the Roto-Guard, machinery safeguarding mechanism designed to convert rotary motion into an electrical signal. This signal impulse may be used to energize an alarm system or operate control switches automatically. *Bin-Dicator Co.*, Detroit, Mich.

Circle No. 315 on Reader Service Card

SPEED REDUCER . . . Bulletin No. R-40 is a 16-pager, contains descriptions and selection data on worm gear speed reducers. Different mountings and shaft projections also are illustrated. *Perfection Gear Co., American Stock Gear Div.*, Harvey, Ill.

Circle No. 316 on Reader Service Card

TOOTHED BELT DRIVE . . . engineering data book has detailed information on selection, design, installation, operation, and maintenance of toothed belt drives. Typical uses are described and illustrated. *R. & J. Dick Co., Inc.*, Totowa, N. J.

Circle No. 317 on Reader Service Card

RETAINING RINGS . . . are now available through a new method of packaging and distributing small-lot quantities. You can get more information on this program. *Waldes Kohinoor, Inc., Truarc Retaining Rings Div.*, Long Island, N. Y.

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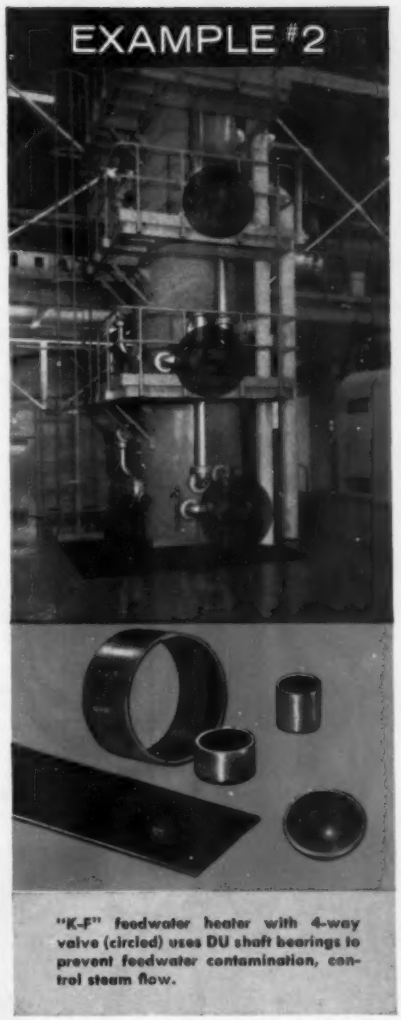

"K-F" feedwater heater with 4-way valve (circled) uses DU shaft bearings to prevent feedwater contamination, control steam flow.

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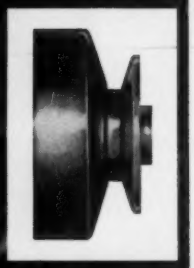

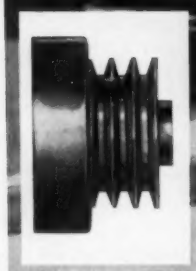

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Circle No. 3 on Reader Service Card

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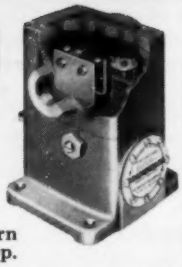
MOTION INDICATOR



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PROTECTS MACHINERY BY INDICATING STOPPAGE DUE TO OVERLOADING OR MALFUNCTION

A and B: On end return idlers, warn if conveyor should break, slow or stop.

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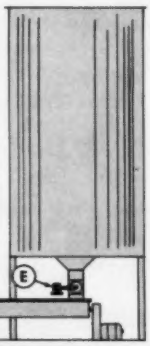
Roto-Guards can be wired into interlock system; stoppage of one component automatically stops others; prevents damage.



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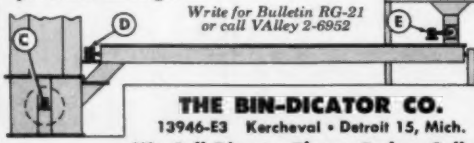

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Circle No. 41 on Reader Service Card

SPHERICAL ROLLER . . . bearings Bulletin No. 113 describes how super finishes on rollers and raceways give longer life and better performance. *Hoover Ball & Bearing Co.*, Ann Arbor, Mich.

Circle No. 319 on Reader Service Card

MINIATURE BEARING . . . design and purchasing manual has 140 pages covering miniature and instrument ball bearings. Complete specifications on 370 standard bearings from 1/10 to 5/8 in. OD are included, as well as 22 engineering bulletins discussing factors in bearing life and operation. *New Hampshire Ball Bearings, Inc.*, Peterborough, N. H.

Circle No. 320 on Reader Service Card

REVERSIBLE COUNTER . . . is a small, 4-digit, low cost type with .468 in diameter drums. Spec sheet gives complete details. *Haydon Instrument Co.*, Waterbury, Conn.

Circle No. 321 on Reader Service Card

MARINE HYDRAULICS . . . Bulletin 202 has 12 pages of data on hydraulic pumps, motors, and valves for commercial and military marine use. Operating characteristics of pumps and fluid motors for hydraulic service up to 5000 psi also are shown. *Denison Engineering Div., American Brake Shoe Co.*, Columbus, Ohio.

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CLUTCHES AND BRAKES . . . which are miniature electro-magnetic control components are said to be ideal for multi-speed devices, direction changers, and machine tool controls where small size, light weight, fast response, high torque, and low cost are the design criteria. Data sheet gives details. *Autotronics, Inc.*, Florissant, Mo.

Circle No. 323 on Reader Service Card

MINI-JOINTS . . . are miniature universal joints with zero backlash, and they're used in instrumentation equipment or other systems. Spec sheet gives complete details. *Falcon Machine & Tool Co., Inc.*, Cambridge, Mass.

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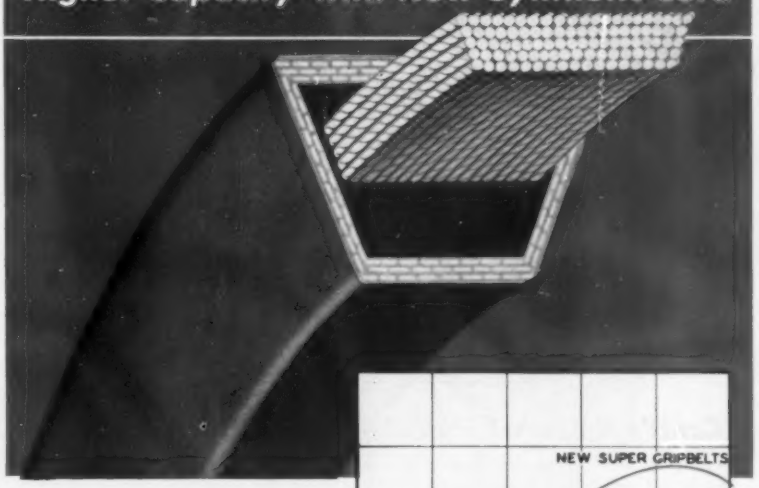

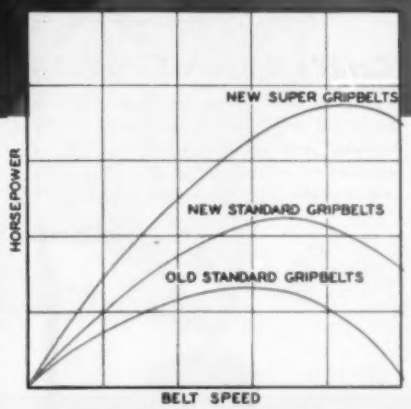

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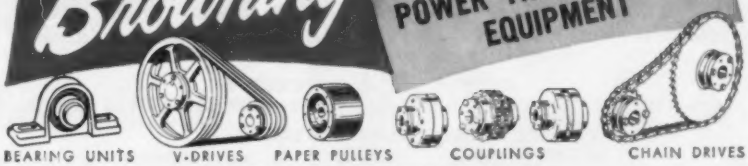

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LITERATURE *continued*

SPLIT BALL BEARINGS . . . are defined and described in a brochure, which also points out advantages and typical applications. *Split Ballbearing Corp., div. of Miniature Precision Bearings Inc.*, Lebanon, N. H.

Circle No. 325 on Reader Service Card

HIGH TEMPERATURE SEAL . . . is a floating mechanical labyrinth type for high speed, high temperature use. Bulletin L gives details. *Cartriseal Corp.*, Lincolnwood, Ill.

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CAST BRONZE ALLOYS . . . used for bushings and bearings are listed in a brochure. Chemical and physical specifications of 29 alloys are given, and there's a chart indicating the compressive strengths of selected alloys and how these properties vary with the thickness of the metal. *Renewal Service Inc.*, Philadelphia, Pa.

Circle No. 327 on Reader Service Card

PILLOW BLOCKS . . . Bulletin BU-102-A describes malleable tapered roller pillow blocks, emphasizing these features: unbreakable malleable housings, Timken tapered roller bearing, eccentric locking collar, labyrinth grease seals, elongated bolt holes, and completely assembled. *Browning Mfg. Co.*, Maysville, Ky.

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PLANETARY AXLES . . . are described in Bulletin 1100 PA. Design principles are explained, showing how planetary axles reduce speed and increase torque in two steps by means of a conventional differential and a system of sun and planetary gears in the wheel hub. Axle shaft torsion is said to be reduced as much as 70%. *Clark Equipment Co., Automotive Div.*, Buchanan, Mich.

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VARIABLE SPEED BELTS . . . Catalog VSB-1 is a 32-page selection guide for variable speed belt users, and includes ratings, sizes, engineering data, applications, and variable speed cross reference tables. *Maurey Mfg. Corp.*, Chicago, Ill.

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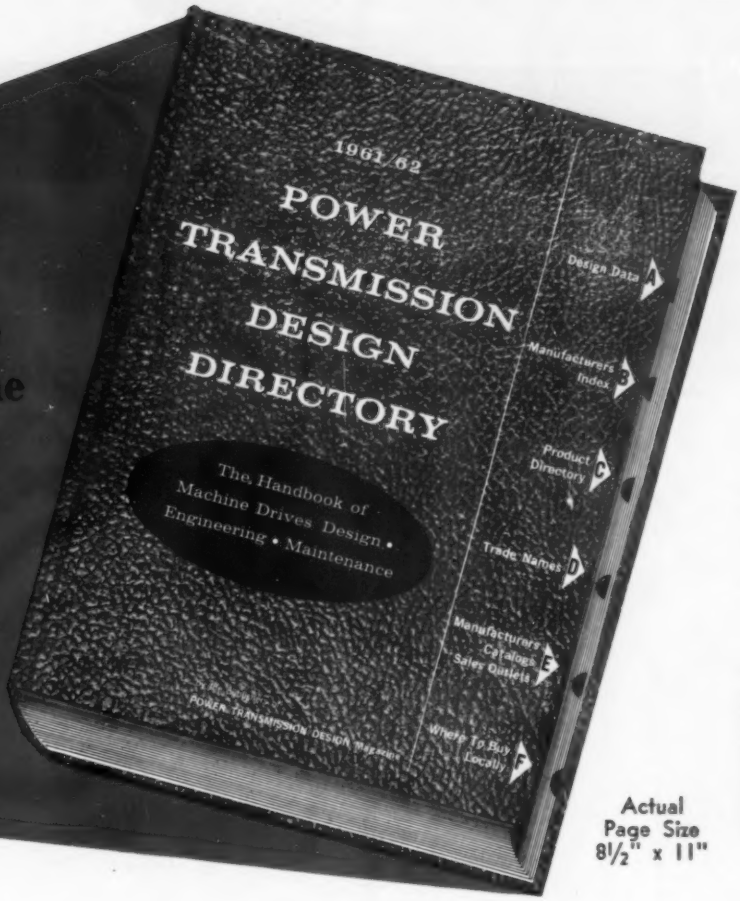
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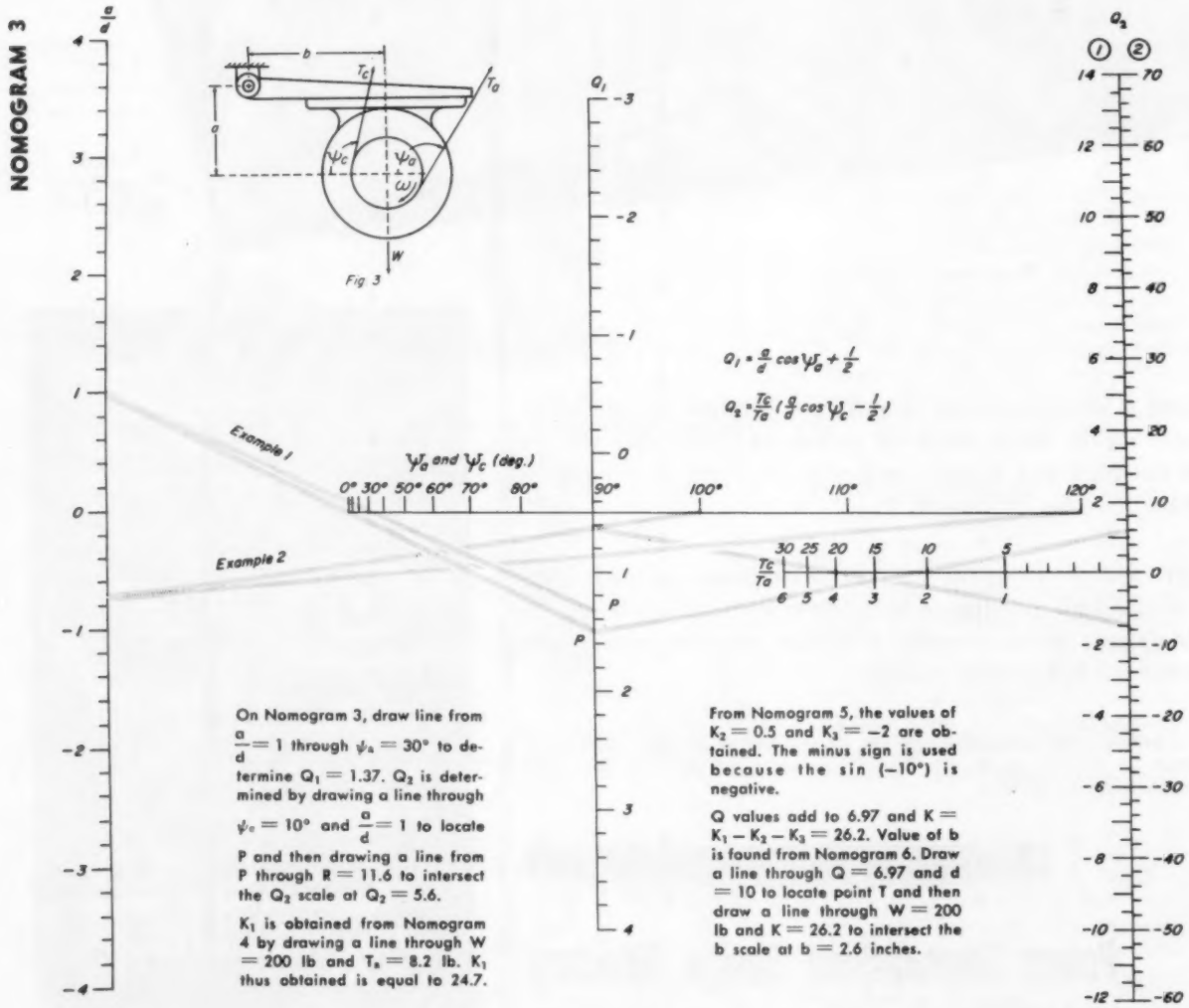
NOMOGRAM 3



On Nomogram 3, draw line from $\frac{a}{d} = 1$ through $\psi_a = 30°$ to determine $Q_1 = 1.37$. Q_2 is determined by drawing a line through $\psi_c = 10°$ and $\frac{a}{d} = 1$ to locate P and then drawing a line from P through R = 11.6 to intersect the Q_2 scale at $Q_2 = 5.6$.

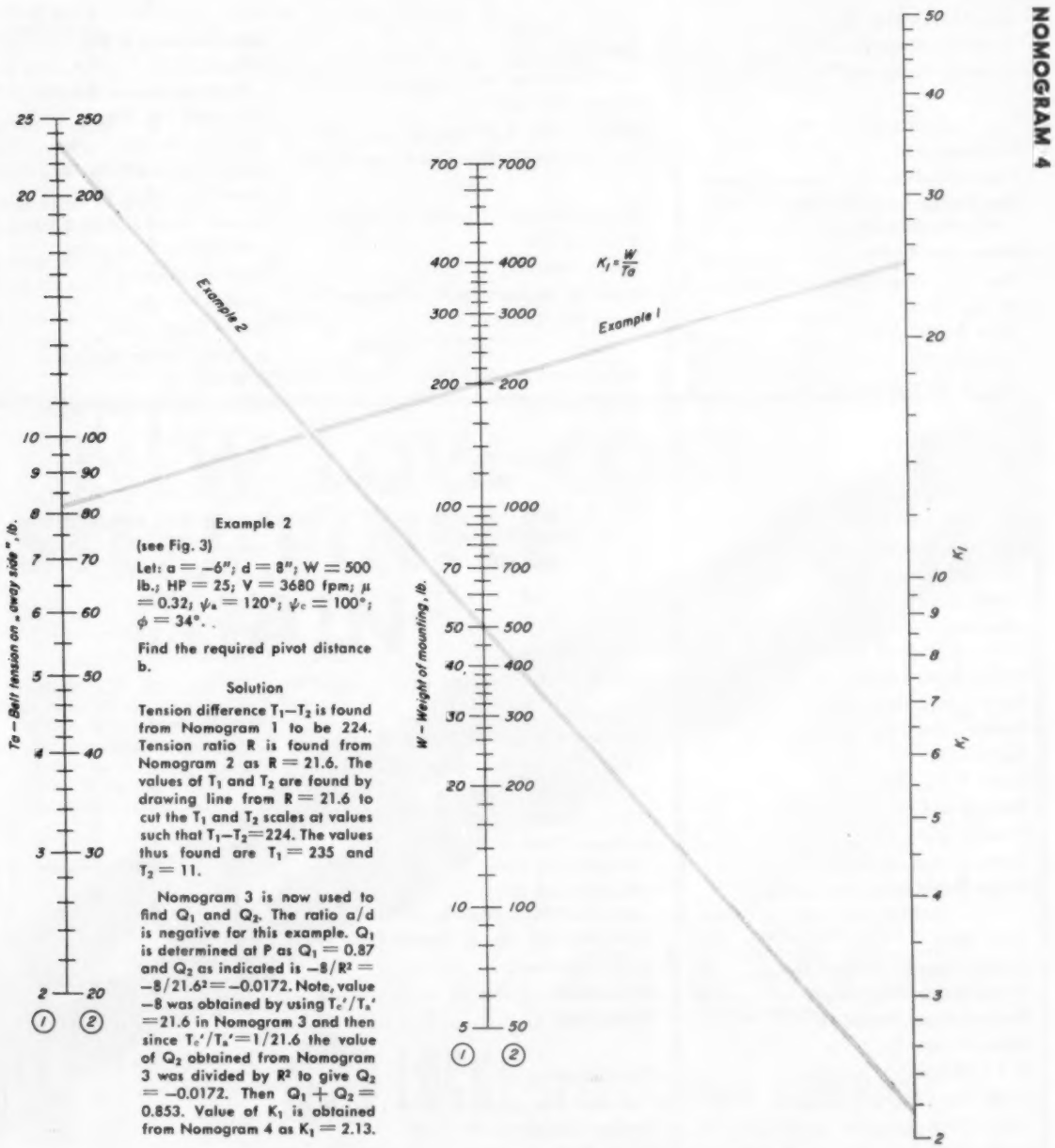
K_1 is obtained from Nomogram 4 by drawing a line through W = 200 lb and $T_a = 8.2$ lb. K_1 thus obtained is equal to 24.7.

From Nomogram 5, the values of $K_2 = 0.5$ and $K_3 = -2$ are obtained. The minus sign is used because the sin (−10°) is negative.

Q values add to 6.97 and K = $K_1 - K_2 - K_3 = 26.2$. Value of b is found from Nomogram 6. Draw a line through Q = 6.97 and d = 10 to locate point T and then draw a line through W = 200 lb and K = 26.2 to intersect the b scale at b = 2.6 inches.

Part 2
Two nomograms in next issue will complete series

By J. N. ARNOLD, *professor, and*
ALLAN C. DUNK, *assistant professor, Purdue University*



Example 2

(see Fig. 3)

Let: a = –6"; d = 8"; W = 500 lb.; HP = 25; V = 3680 fpm; μ = 0.32; ψ_a = 120°; ψ_c = 100°; ϕ = 34°.

Find the required pivot distance b.

Solution

Tension difference $T_1 - T_2$ is found from Nomogram 1 to be 224. Tension ratio R is found from Nomogram 2 as R = 21.6. The values of T_1 and T_2 are found by drawing line from R = 21.6 to cut the T_1 and T_2 scales at values such that $T_1 - T_2 = 224$. The values thus found are T_1 = 235 and T_2 = 11.

Nomogram 3 is now used to find Q_1 and Q_2. The ratio a/d is negative for this example. Q_1 is determined at P as Q_1 = 0.87 and Q_2 as indicated is $-8/R^2 = -8/21.6^2 = -0.0172$. Note, value –8 was obtained by using $T_c'/T_a' = 21.6$ in Nomogram 3 and then since $T_c'/T_a' = 1/21.6$ the value of Q_2 obtained from Nomogram 3 was divided by R^2 to give $Q_2 = -0.0172$. Then $Q_1 + Q_2 = 0.853$. Value of K_1 is obtained from Nomogram 4 as K_1 = 2.13.

For free copies of all six nomograms, Circle No. 250 on Reader Service Card

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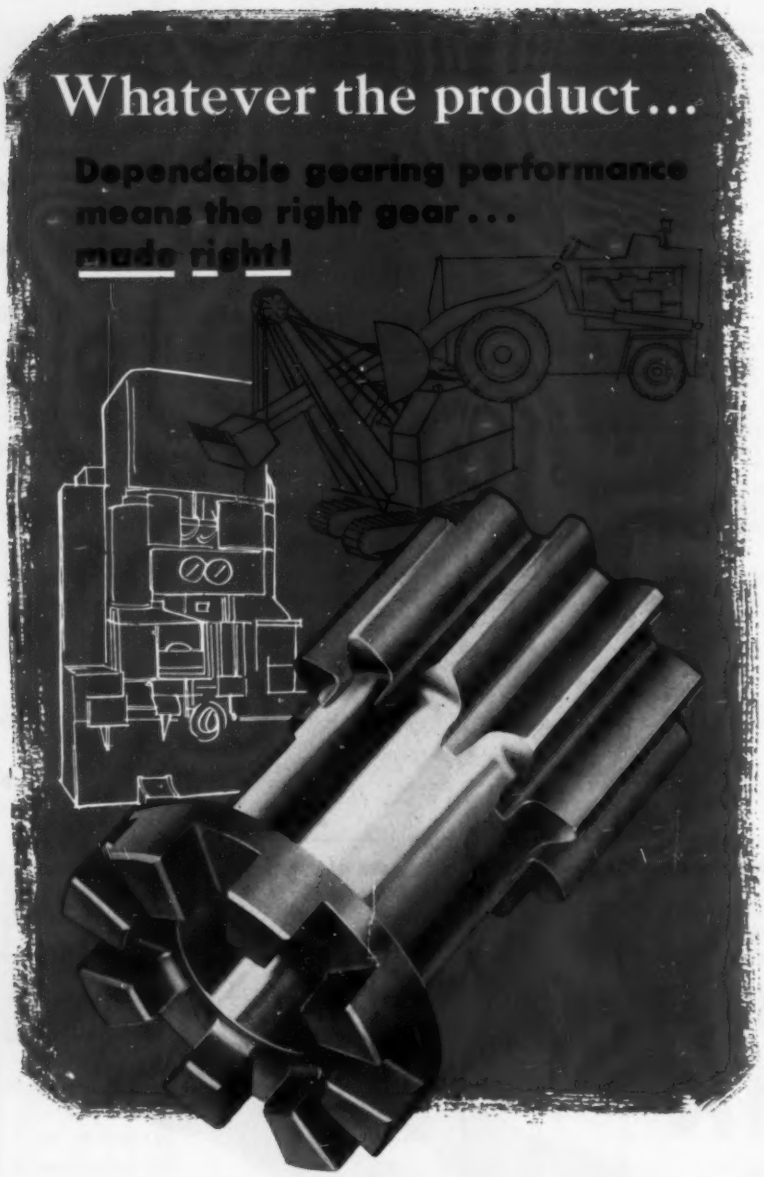

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CASTING COST	$	NONE
TOOLING COST	$	NONE
MACHINING COST	$	NONE*
SCRAP LOSS	$	NONE
TOTAL COST	$	$12.70
DELIVERY DATE	?	IMMEDIATE

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